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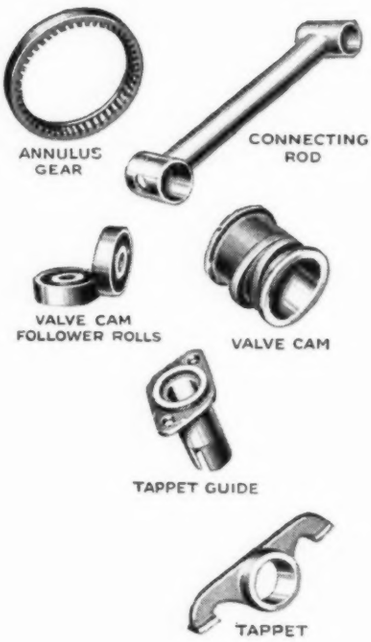

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Dreams That Came True

SINCE first the world began men have dreamed dreams of better things. Among the wandering tribes, among the shepherds in the hills and down through the ages to the present, men have sensed possibilities of development far beyond their day. The high priests of Egypt could, so the story runs, swing wide the temple doors by mechanism hidden below. Leonardo da Vinci, he of many parts, not only dreamed but planned all manner of devices, motor vehicles, airplanes, mechanisms of many varied types. All through the ages has run the same striving for ways and means of changing time worn customs—and all with one aim — the lightening of human labor.

IN SPITE of these dreams, however, and they date back into the early centuries, even the most advanced conceptions remained dreams—nothing more. Not for lack of ideas as to what was wanted, but because there was no way of producing the desired devices, even had the materials been available. The designs lay fallow because no machinery was available for the building of the mechanism desired.

Casting and forging are old accomplishments, dating back into the early centuries. But the shaping of metals, except by molding in sand or by heating and hammering is not an old art. True we have the old attempts at drilling and turning in the Far East and elsewhere, using bowstring drills and spring poles for turning, but as late as the days of Watt and Newcomen, the great handicap was the inability to secure even moderately accurate machining of parts.

The lack of proper machines to turn and bore and to produce flat surfaces prevented the advanced dreams of the thinkers from becoming realities. Machine tools had not been developed and without them mechanical progress was impossible.

WITH the recognition of the need for better machine work, for better working fits, the inventive genius that had heretofore dreamed only of new mechanisms turned its attention to ways in which these mechanisms could be made. The lathe, the slide rest, the lead screw, the planer and other tools began to appear and the trend toward labor-saving machinery was on its way.

All through the years that have followed the same law can be seen, the development and use of labor-saving machinery has been dependent on the kind of machine tools available for their manufacture.

As with all development, mutual co-operation has been necessary. Without the vision of tool builders as to what might be accomplished we should have none of the special, high-production machines that seem almost human. Without the courage of the users of these machines to purchase expensive equipment in the belief that the reduced costs would open wider markets, the tool builder would have no outlet for his labor-saving machines.

BOTH maker and user of modern machine tools realize their mutual dependence. But the difference in the volume of their outputs and their markets makes it difficult for the user, accustomed to a large output, to appreciate the position of the builder whose output is, of necessity, limited. The builder of automobiles, for example, with an output in the hundreds of thousands, knows the low cost of building high-grade machines—in quantity. He is, very naturally, apt to judge the cost of the machines he buys by the cost of his own product.

Instead of building machines by hundreds of thousands, however, the tool builder is frequently limited to an output of a few hundred machines. Not per year, but as a total of the sales to be expected. Instead of spreading his development costs over hundreds of thousands of units, they must be absorbed by a few hundred. Nor can he, in many cases, utilize the high-production machinery that he sells his customers.

THESE are some of the reasons why the tool builder's prices seem high to the user who thinks in terms of large quantities. When, however, the user will ask himself what he would be obliged to charge if he could look forward to a total market of but a few hundred machines—instead of selling thousands per year—he would readily see the great difference between the two methods of doing business.

We still have dreamers of better things. But instead of idle fantasies with no means of fulfillment, we now have machines and methods by which the seemingly most fantastic dreams may become everyday realities.

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American Machinist

Editors
Kenneth H. Condit
Fred H. Colvin

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Observations on Czechoslovakian Shop Practice

By K. H. Condit
Editor, American Machinist

SOME people have likened the situation of the new republic of Czechoslovakia to that of the much older inland republic of Switzerland. There are similarities, of course. Neither one has access to the sea. Each has the problem of reconciling peoples that speak different languages. Each must be prepared against aggression by neighboring states.

But Switzerland has had many years in which to work out its problems — Czechoslovakia only ten. The story of the founding of this new republic, of the release of its subject peoples from imperial domination, is a modern epic. What has been done in ten short years toward the firm establishment of a modern state is little short of marvelous. There are still many misfits, many things that are obviously wrong, yet the promise for the future is very good. An American visitor, interested in underlying conditions and in industrial development, senses at once upon reaching Prague, the capital, that he is meeting something a little different from what he has encountered in Western Europe. At least, this one did. Perhaps it is the first touch of the East, the effect of the psychology of the Slav. But, whatever it is, one realizes that he is in a different land.

There are certain formalities to be observed, unnecessary they may seem perhaps to the casual, matter-of-fact American, but entirely pleasant when he gets accustomed to them. One soon learns to remove his hat when meeting another man and to shake hands four or five times on parting. They are not in such a hurry in Czechoslovakia as we are in the United States and there is plenty of time for small amenities.

There is, to be sure, a far greater respect for authority than we are accustomed to, a leftover from monarchial days, perhaps. That will probably yield to more democratic notions in time, but it has some unhappy results on occasions. For instance, in one big plant a trucker with a full load on his electric truck was proceeding down a main aisle. In his path were three company officials discussing some pressing problem. Did he blow a blast on his horn to let them know that they were obstructing the smooth flow of work through the factory? Not he. He stopped his truck and waited patiently for five minutes until they had finished their talk and moved away. Then he went on with his cargo. That incident may not be typical of the attitude everywhere but I saw enough others in my brief visit to lead me to believe that it is sufficiently so to merit careful consideration on the part of the industrial executives of the country.

> Czechoslovakia as an independent state is now ten years old. Always able to raise the food they need, the people are endeavoring to become independent industrially as well. The progress being made is commendable. American equipment and methods are in high esteem. Wages are, however, low in comparison with our American standards

In the foundry one finds other evidences of a different habit of living. Most of the molders work barefooted and so do many of the women helpers and coremakers. All through the plants, in fact, there is evident a disregard of dress conventions as they confine the Westerner. Some of the men work stripped to the waist. Most of the women go without stockings—for which reason they do not have to bother about oil spots as do their sisters in England and France. Part of this general habit of physical exposure is probably a result of the national propaganda for as much exposure to sunshine during the summer months as possible, but most of it, I am inclined to believe, is attributable to old traditions. There is a very real reason for getting as much sunburn as possible when the sun

shines in Czechoslovakia, because the climate for the greater part of the year is cold and raw, and sunny days are few. The farmers and their male and female helpers can get their full share of sunshine, of course, as they work in the fields, but it is not so easy for the factory workers. After hours the men work in their gardens or small farms clad only in a pair of trousers, while the women and girls wear dresses without sleeves and roll their stockings to the ankle. And apparently everybody goes swimming in the rivers on the slightest provocation and dressed in the scantiest of bathing suits. At least, that is the impression one gets as he travels through the country by train or motor car.

Some relief for the factory workers might be had if the buildings had more window space, but in Czechoslovakia, as in other European countries, they are strong for masonry and permanence of construction. The men with whom I talked found it hard to understand how we could possibly heat our steel and glass factories in America even if the cost were not taken into consideration. Well built double windows are in general use, but central heating is not.

Shop equipment is strangely varied. In one department you will find German tools that date from the war, or earlier. In the next will be some of the best American precision and production machines. The largest buyer of machine tools in the country told me that when precision or high production was the requirement he bought American tools. For ordinary simple operations where high precision was not needed he used German ones because they were good enough and less expensive.

Belt Drive Favored

Belt drive is almost universally used. The Czechs are watching expenses closely and they believe that it is more important to save the cost of the extra current used by an individually-driven machine at the expense of flexibility of arrangement and the interference of the belts with general lighting. Some thought has been given to artificial lighting, but not enough, I should say.

Material handling is embryonic. There are some electric trucks and in one shop I saw standard containers, but hardly a start has been made in progressive assembly. As to inter-machine transportation, that is yet to come.

Like the Swiss, many of the Czechs are wide travelers and there is a fair sprinkling of engineers and production men with experience in American shops. They are making a strong effort to overcome old traditions and there is considerable progress to report. In one big plant, for example, they have adopted a standardized lathe tool patterned somewhat after the DeLeeuw and Klopstock designs with recessed top surfaces.

Czechoslovakia is making a valiant effort to become self-sufficient. Unlike Switzerland she has within her own borders most of the raw materials she needs and she raises more than enough foodstuffs for her own needs. As a part of this program an attempt is being made to manufacture automobiles and other mechanical devices for domestic use. The market being limited on account of the relatively low wage levels and standard of living, each company is trying to put out a full line of its products instead of sticking to one model. The result is that lots are small and production economies extremely difficult to accomplish. Costs are correspondingly high and it has therefore been necessary to protect the industries by high tariffs and various other restrictions.

I was told by several men in a position to know what is being attempted that the only chance for Czechoslovakia to compete in foreign markets is on a price basis, the adverse differential of freight charges to the sea being balanced by the relatively lower wages paid to the Czech workman. The scale of wages is certainly low but it is compensated for, in part at least, by the fact that most of the men have farms on which they can raise their own food with perhaps some surplus to sell.

This situation has been largely responsible for the hours worked in some of the plants. The largest one is running two shifts, six to two and two to ten. No time is taken out for lunch or any other meal, the men preferring to work steadily for eight hours and devoting the time saved to work on their farms. They keep going by carrying a roll or hunk of bread in a convenient pocket, munching on it whenever the occasion offers or hunger makes it imperative.

Which is all well enough for those accustomed to it but not so pleasant for the unsuspecting visitor, particularly if he has come straight from a country where they take two hours for lunch and make good use of the time.

One of the unsolved problems is that of the transportation of the workers between farm and factory. A few can go by train, others use bicycles and I was told of one man who walked to work, three hours there and three hours back.

At one plant we had a little discussion on this matter of transportation during the course of which I pointed out that an American mechanic could get a used automobile for as little as fifty dollars that could be tinkered into shape in his spare time and serve as a quick means of getting to and from work. My hosts asked how long it would take an American foreman to save up the necessary money to buy such a car. I hazarded a guess that he might do it in two or three months if he were not buying too many other things on the installment plan. They estimated that it would take a Czech foreman 17 months to save the same amount, and stated positively that a workman would never save that much money in his whole working life.

Taxes Handicap Industry

There are other troubles for the manufacturer, among them the heavy taxes and the socialistic laws that the new state has thought it wise to enact. Compensation laws, old age insurance and the like take a heavy toll from profits, but with wages as low as they are it has been felt necessary to give the men protection in this way.

Government ownership of public utilities or at least government participation in the ownership has been chosen as the way to finance the much needed improvements of this sort. Complaint was made from one source that American capital willing to enter the country demanded a return of 10 to 12 per cent. This seemed a bit high until I heard from another source that that was exactly what the powerful local banks asked—and got. Perhaps the risk justifies that rate of return.

I believe that there is in Czechoslovakia a strong feeling of friendship for the United States. That feeling should be reciprocated because the Czechs are now going through some of the misery we endured in the early days of our life as a nation. Their strength is perhaps largely potential as yet, but they are working hard and, on the whole, wisely to accomplish their national aims. American industrialists who go to Europe should take the time necessary to visit Prague and other cities as well. It is the only way they can find out what is really going on in this border state between West and East.

MAINTENANCE of *Trucks Wheels Gears Axles*

Efficient maintenance is secured on the Brooklyn-Manhattan Transit lines by utilizing modern machine tools in the new Coney Island shops

By CLARENCE W. SQUIER
Associate Editor, Electric Railway Journal

DUE to the large volume of wheel, gear and axle inspection and repairs on most electric railways, and to the necessity for repeating maintenance operations continually, the work is placed on a production basis more often than other railway maintenance procedures. As a result it is quite common to find wheel and axle work done in sections of the shop set apart for this purpose. The wheel press, boring mill, axle lathe and wheel lathe universally used for this work are usually grouped to eliminate unnecessary handling. With the combination of a new shop at Coney Island and new machine tools, the mechanical department of the Brooklyn-Manhattan Transit lines has been able to perfect a most effective department for this work. The wheel and axle department occupies a section of the shop 60x200 ft. Not all of the machine tools have been installed, but when completely equipped the department will include the tools listed in the accompanying table. A large section just east of the shop provides convenient open departmental storage for wheels, axles and shafts. This material is handled by overhead electric crane and electric crane trucks through doorways directly to boring mills or lathes for the machine work. Mounted wheels that come from the truck overhauling or repair departments are handled by overhead crane, and enter and leave the section at the wheel lathe end. The entire department is also served by a 7½-ton overhead traveling crane, while groups of machines have jib cranes, there being four of these in the department, each having an 18-ft. boom.

The number of times that wheels and axles are handled and the amount of handling equipment has been kept to a minimum by particular attention to location and grouping of machines. Wheel boring is done in the central part of the section. Each of the Sellers 48-in. car wheel boring machines has two built-in jib cranes. While one wheel is being bored another is picked up and held in position by one of the cranes to be swung on to the table of the mill as soon as the boring of the wheel in the mill is completed. The other jib crane with the previously finished wheel in suspension deposits it on a truck placed alongside. In Fig. 1 this is shown. From the boring mill, wheels to be mounted on axles go to the Chambersburg Engineering Company

Fig. 1—Car wheel boring machine. This machine is provided with two cranes, one for loading and the other for unloading. The crane at the left is supporting a wheel ready to swing it on the boring machine table as soon as the one in place has been finished. The crane at the right removes the finished wheel and loads it on the truck shown

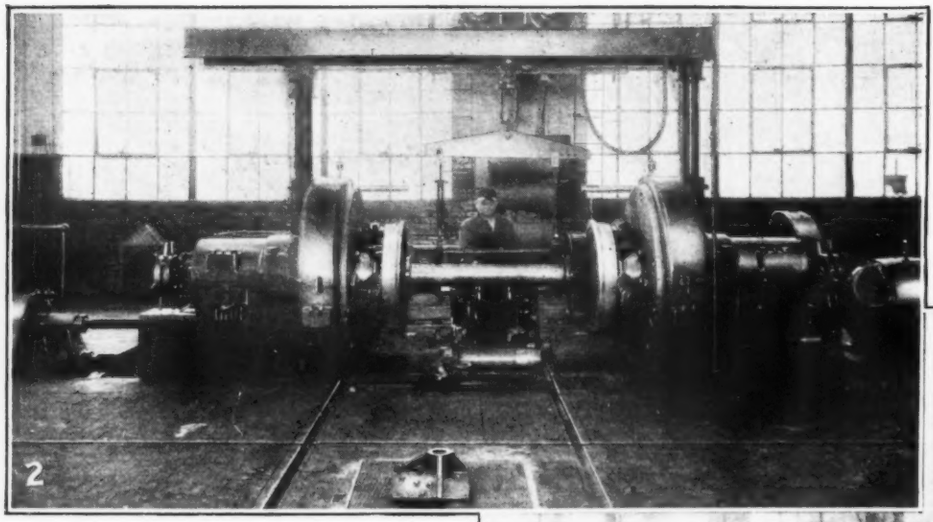


Fig. 2—Pressing on a pair of wheels on a 400-ton hydraulic press. This is a double-ended machine, so that both wheels can be pressed on at the same time. This saves the necessity of turning the axle end for end, and mounts wheels in about half the time formerly required

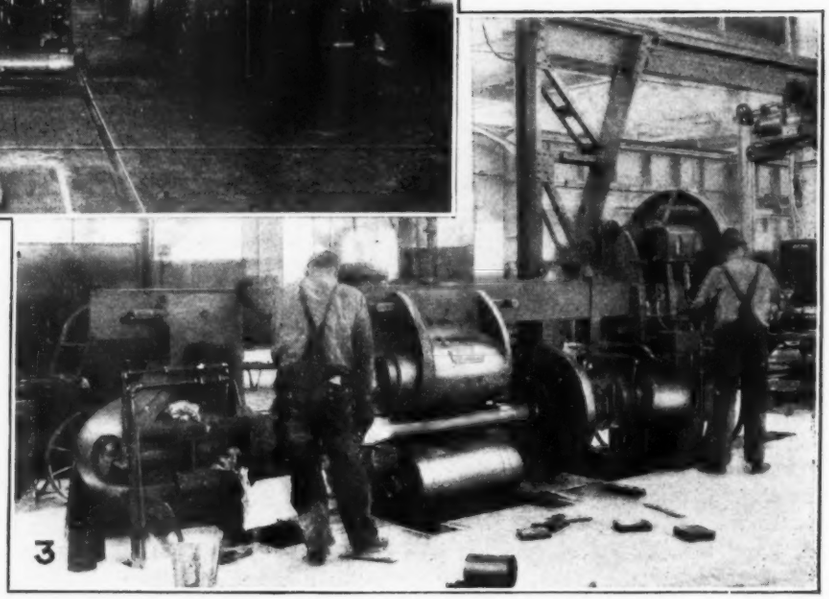


Fig. 3—Modern wheel lathe turning both tires at the same time. There are two turret tool-posts, each carrying four tools, that turn the treads and finish the flanges at the average rate of three pairs of wheels per hour

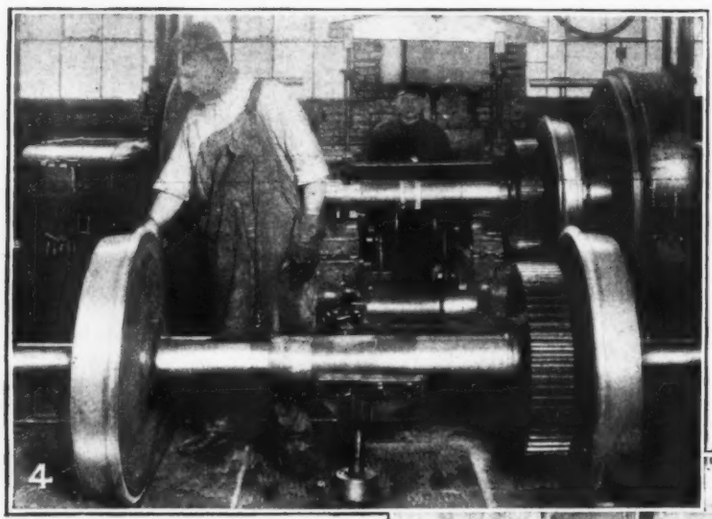


Fig. 4—Pneumatic lift to enable the helper to transfer wheels from the cross track to the track leading to the wheel lathe. After the wheels are raised by the pneumatically operated plunger, it is an easy matter to swing them 90 deg. and lower them on the other track

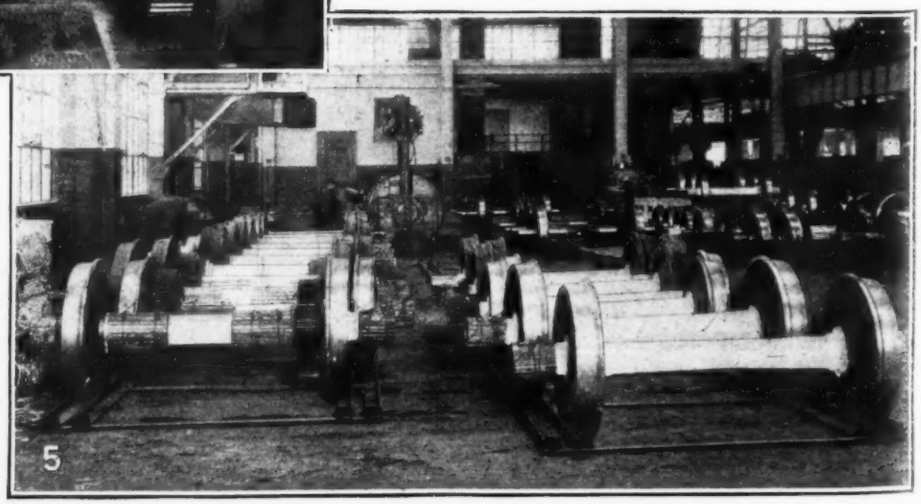


Fig. 5—Mounted wheels are stored in the racks shown here in order to keep them off the floor. These racks are made of angles and are so arranged that the wheels stagger and fit into the adjoining pair so as to save room in the storage space

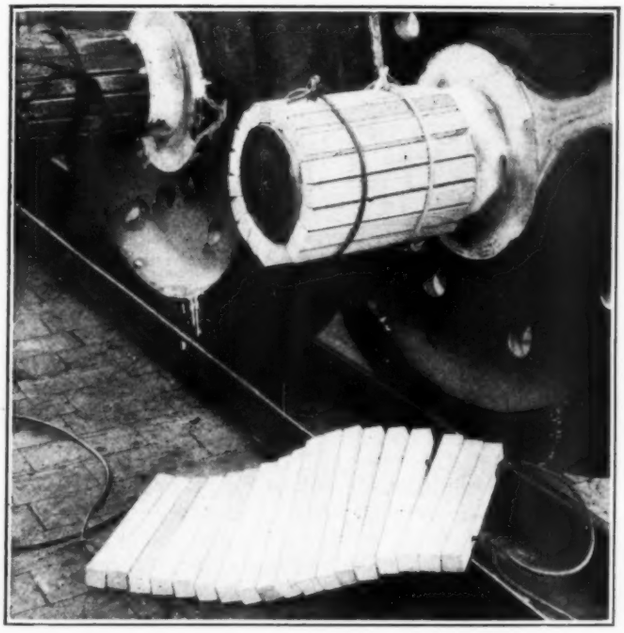


Fig. 6—Method of protecting finished journals on car axles. This is a very simple and effective method, and consists of a sufficient number of square wooden strips strung on bell cord. Having a supply of these, it is an easy matter to wrap them around the journal and tie the ends of the cord. The method affords ample protection and the guards can be used indefinitely

double-acting, 400-ton, hydraulic wheel press. This machine is used also to press gears on and off. The double pressure heads, Fig. 3, make it possible to dismount both wheels from a trailer axle without the necessity of removal, after one wheel is pressed off, in order to turn the axle for pressing off the remaining wheel.

Hydrograph chart records are kept of each pressing-on operation. These are numbered consecutively for each day's work, and a notation is also made on each record of the wheel number, the man who fitted the wheel, and the diameter of its bore. Each day's records are put in an envelope and filed by dates. If it is necessary to consult the records for a particular wheel pressing later, the truck overhauling report furnishes the date wheels were changed and number of the wheels. The hydrograph records for that date with wheel number identify the particular operation. In addition, a book record for each pressing is kept at the press. When filled these books are filed.

Subway motor axles have a seat for wheels $7\frac{7}{16}$ in. to $7\frac{5}{16}$ in. in diameter, and trailer axles have a wheel seat of $6\frac{1}{2}$ in. to $6\frac{3}{8}$ in. in diameter. Pressures for forcing wheels on must be not less than 75 tons nor more than 95 tons for motor axles, and between 70 and 90 tons for trailer axles. The wheel seat for a standard subway axle may vary 0.001 in., plus or minus. Wheels are bored 0.001 in. per inch of diameter smaller than the axle. This gives a pressing-on pressure of from 10 to 12 tons per inch of diameter. Complete information regarding wheels and axle fits for the different equipment in operation, pressing-on, pressures, mating of wheels, scrapping diameters, etc., is furnished the wheel and axle department in blueprint form.

In mounting wheels it is the practice to have both wheels on the same axle of the same tape size. A special type of gage is used for gaging wheels. This has one side for gaging new and newly turned wheels and the other for gaging partly worn wheels. New and newly turned wheels are gaged from throat to throat, while worn wheels are gaged from back to back.

As the wheels used on the rapid transit motor axles have diameters ranging from $30\frac{1}{4}$ to $34\frac{1}{4}$ in., and gears have outside diameters of 25 in. to 27 in., it is possible to support the wheels at the rim for pressing off. A circular yoke has been supplied by the manufacturer of the press to go over the outside of the gear and fit between the rim of the wheel and the center frame of the press, during the pressing. The yoke is suspended from a pipe framework with a roller support so it can be put into position or swung out of the way easily by the operator.

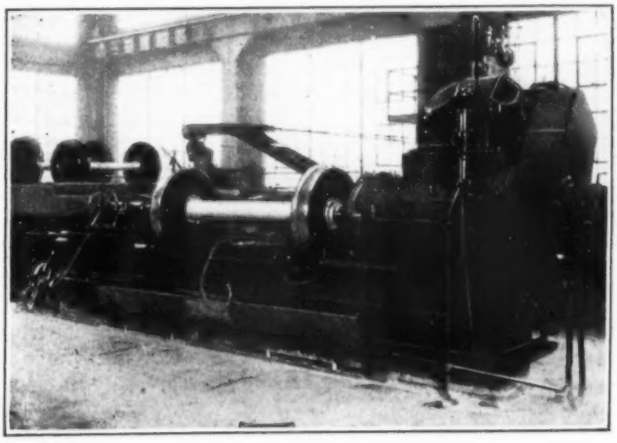


Fig. 7—Heavy-duty lathe for re-turning the journals on axles in mounted wheels. The axles are brought to the lathe on the flat car shown so that the amount of handling necessary is reduced to a minimum

The Brooklyn system was a pioneer in the use of steel wheels for electric railway service, adopting them in 1905. Excellent results and substantial economies have been obtained. By concentrating all wheel and axle work at one point, under the direction of one man, every mile of service consistent with safety is obtained from the wheels.

The different maintenance foremen are expected to see that the wheels are worn to, but not below, the various scrapping dimensions which are furnished them in blueprint form for their guidance. New wheels for subway motor axles are $34\frac{1}{4}$ in. in diameter and can be worn to $30\frac{1}{4}$ in. Subway trailer wheels are of 31 in. diameter when new and can be worn to 27 in. When the

Machine Tools for Wheel and Axle Section of Coney Island Shops

Two extra high power wheel turning lathes.
Three 48-in. heavy-duty wheel boring machines.
One 400-ton hydraulic wheel-mounting press.
One 200-ton hydraulic axle-straightening press.
Three 40-in. x 14-ft. heavy-duty geared-head engine lathes.
Four 8-in. Lo-Swing axle lathes.
Two 20-in. wet tool grinders.
One external key seater.
Two 20-in. wet tool grinders.
One axle-testing stand with tanks.

wheels removed from the trucks are received in the wheel shop, they are checked carefully with gages to ascertain dimensions and defects. An inspector also checks the axles carefully and measures them to determine whether truing up is needed and also to make certain that the bearing fits on the trued-up axles are above the scrapping limit. If a bearing fit will not true up above scrapping dimensions the inspector paints it red and the wheels and axle are routed to the wheel press for removal of the wheels. The same inspector who inspects bearing fits also determines whether the wheels can be returned to service and indicates any work that is necessary. If it is found that the wheel will not true up to $\frac{1}{4}$ in. above the scrapping limit it is marked for removal.

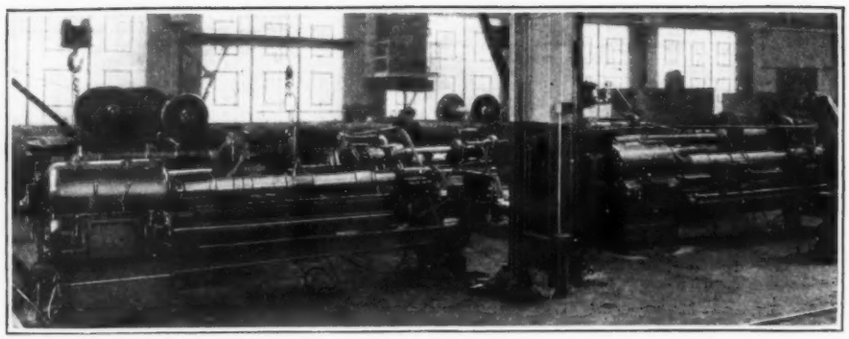


Fig. 8—Where axles are turned and ground Two large, Lo-Swing lathes are shown in the foreground, served by a jib crane and its hoist, by which the axles are easily handled in and out of either lathe. Behind these lathes is a Landis grinder, on which the journals are finished. A saving of 25 per cent is reported in machine work with a longer life bearing

For steel wheel maintenance work the wheel lathe is an important and busy tool. At present, one high-powered lathe, Fig. 2, is doing the work. This was supplied by William Sellers & Company, Philadelphia, Pa. Three pairs of wheels per hour are turned out, on an average. Handling of the wheels is speeded up considerably through the use of pneumatic floor lifts and a hoist which forms a part of the lathe. The lathe has two turret tool posts, each arranged to hold four tools. There is a roughing tool for the wheel tread, a flange roughing tool, a combined tread and flange finishing tool, and a chamfering tool. The lathe swing is 42 in. and a $\frac{3}{8}$-in. cut can be made at high speed. Through the use of an efficient clamping arrangement wheels can be removed and new ones put in place for turning in two minutes. Only one man and a helper are assigned to the lathe. The helper assists in wheel handling, sweeps up chips, oils the machine, takes wheel measurements and does other work necessary while the wheels are being turned.

The wheels are rolled directly into position in the lathe on a track. Crossing this at right angles are two tracks used for the incoming and outgoing mounted wheels. There are two pneumatic floor lifts, one in the center of each crossover, Fig. 4. The helper rolls a mounted pair of wheels along the incoming track to the crossover, steps on a button controlling the valve to admit air to the hoist cylinder of the lift, and the plunger raises the wheels free of the track. The wheels are rotated a quarter turn and then are lowered to the track leading to the lathe. The action is reversed to remove a pair of wheels after turning. This has proved an easy and quick method for serving the lathe.

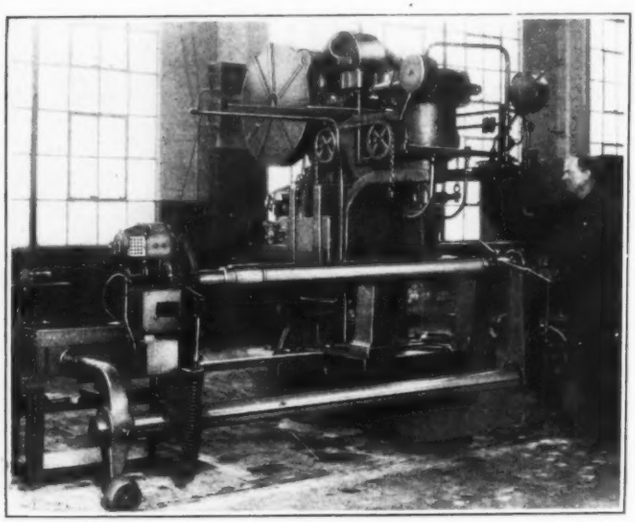


Fig. 9—A 200-ton hydraulic press for straightening bent axles. Every axle without wheels is tested and straightened if necessary. The axle is carried on centers which are mounted on the sliding truck, so that any portion of it can be brought under the straightening ram

Inspection of Axles

Each axle is carefully inspected and tested to detect any minute cracks that would be likely to result in breaking later. The axle, with its wheels in position, is wet with a bath of kerosene while on a test stand. The axle is then wiped dry and is painted with a paint of lime in a solution of one-third alcohol and two-thirds water. The alcohol causes the mixture to dry quickly. After numerous tests this proportion was found to give a smoother coating than any other combination or composition. A crack retains some of the kerosene. This penetrates the lime coating quickly and leaves a brown discoloration so that detection is easy. Axles without wheels are dipped in kerosene and then wiped dry and painted with the lime.

After testing, axles with wheels mounted are stored on racks to keep them off the floor until they are removed to other departments or shops for mounting in trucks. Wheel racks have four 3x4-in. angles arranged in pairs, each pair spaced wheel gage distance apart. The angles are fastened together by steel straps to form a rigid framework. Alternate pairs of wheels are staggered so as to take up a minimum amount of room.

Each bearing seat has a protective covering, made of a number of wooden strips strung on small ropes. Each strip is about 1 in. square and of a length sufficient to cover the bearing surface. By tying the loose ends of the ropes together, as in Fig. 6, the covering is held securely.

Bearing seats which are worn tapered, out of round, cut, or have rough fillets are turned in a gap lathe. For this work with wheels in position, two heavy duty American 24-in. by 14-ft. geared-head engine lathes are used, Fig. 7. The bed of the lathe has two gaps for the wheels, the swing in the gaps being 40 in. Each lathe has two carriages, one with two tool posts. With this equipment the two motor suspension axle bearings

and one-truck journal bearing can be trued up at the same time.

New axles have bearing seats $\frac{1}{4}$ in. in the rough oversize when received from the manufacturer. They are turned and ground to accurate sizes in the wheel and axle department. For this work there are two groups of three machines each. In each group there are two 8-in. Lo-Swing axle lathes and one 12x96-in. grinding machine. Bearing fits are turned in the lathe to a size 0.015 in. to 0.018 in. larger than standard. They then go to the grinding machine and are finished accurately to exact size. There are two carriages on each Lo-Swing lathe with three tool posts on each, so that six tools can be used for cutting on the same piece at one time. As a result of the use of these rapid production lathes the time necessary to finish axles has been reduced to one-fourth of that necessary with ordinary engine lathes.

In Fig. 8 one of these lathes is turning a large subway car axle. The various finished fits for this type of axle are, journals 5x9 in., dustguard surfaces $6\frac{1}{8}$x2 in.,

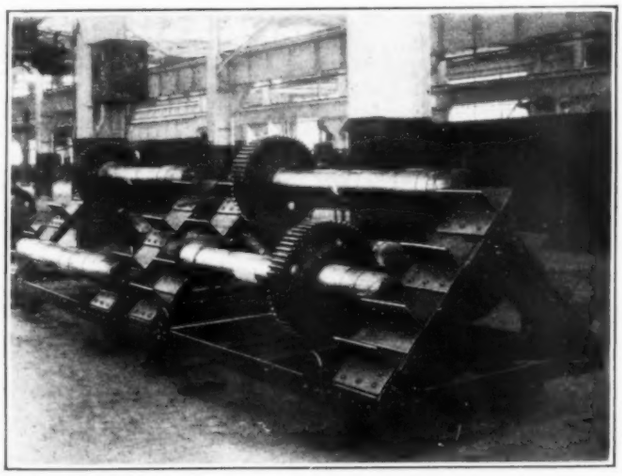


Fig. 10—Portable racks for storing axles either with or without gears. The faces of the angles are covered with $\frac{1}{8}$-in. copper to prevent injury where the journals are not protected by the wooden strips. The rack is 5x8 ft. and is provided with four eyes so that it can be lifted by the crane and carried to any place desired

wheel fits $7\frac{7}{16}$x$6\frac{1}{2}$ in., gear seats $7\frac{1}{2}$x$6\frac{1}{8}$ in., and axle bearings $6\frac{1}{2}$x$12\frac{3}{4}$ in. The total length of the axle is 7 ft. 1 in. With the improved lathe equipment this size axle is turned ready for grinding in an average of three hours. With the single-tool lathe ordinarily used, the machining operations on an axle of this size would require at least three hours for rough finishing, and an additional nine hours for finishing cuts. Previously two different lathes were used, one for roughing and the other for finishing, so it was necessary to change the axle from one to the other. The volume of axle work in the Coney Island shops permits the lathes to be kept busy continuously.

Finishing of axles by grinding has been adopted in the Brooklyn shops. Landis 12x96-in. grinders are used, one being seen behind the lathes in Fig. 9. There is a saving of approximately 25 per cent in the time taken to finish axles as compared with that when they are finished in a lathe. There is also greater accuracy of dimensions and smoothness of finish, so that longer life of bearings results. Where wheels or gears are to be pressed on axles, the grinding finish produces more uniform pressure for the pressing and the grinding finish eliminates irregularities common with filing or rolling, so due to the smoother surface there is a better fit and more surface area in contact between the wheel bore and the axle. This method is also of advantage in produring a better fit of bearing so that the pressure per square inch is reduced. Axles without wheels that have surfaces to be trued up go to the grinding machine. Those with wheels mounted go to the gap lathes for truing.

The 200-ton hydraulic axle-straightening press, Fig. 9, forms an important part of the equipment for the axle section. Every axle without wheels that does not go to the grinder goes to this test machine to determine if it is bent. If so, the straightening becomes an added part of the maintenance procedure.

Besides the machine tools, the axle section contains a large number of portable axle racks, Fig. 10. Each will hold seven axles with gears mounted and they are placed at convenient locations so that the jib crane which serves one of the various machines can deposit an axle in one of these racks after it is turned and is waiting to go to the grinding machine. After grinding, the same jib crane handles the axle to another rack, or an individual axle can be picked up by an overhead traveling crane and taken to another section as desired.

Construction of Axle Racks

These axle racks are constructed of angles and channels. The ends form a triangle. Two 12-in. channels form the top portions of the ends. To these, 6-in. angles are riveted to form the support for the ends of the axles. To prevent injuries to the axles the faces of these angles are covered with $\frac{1}{8}$-in. copper. Gusset plates strengthen the framework at all corners. The complete rack is 5 ft. wide and 8 ft. long. The bottom framework is constructed of 4-in. angles, with a plate at each corner. These are 6 in. wide and $\frac{1}{2}$ in. thick and have holes so that tackle can be fastened to lift the entire rack with load by an overhead traveling crane if desired. As the racks are fitted with wheels they can be moved with their load of axles. The wheels are of 8 in. diameter, and have a 4-in. face. The front axle is constructed of a 4-in. I-beam and has a center bearing and circular side bearings so that it can swivel for turning sharp corners and moving about.

Maintenance work on wheels and axles for the entire B.-M.T. lines is done at the Coney Island shops. There are three other shops where wheels and axles are removed and installed. A wheel supply flat car makes daily trips to and from the shops. Handling of wheels mounted on axles at the Coney Island shops is facilitated by providing a track into the wheel and axle section so the car can be run inside and loading and unloading done with the overhead traveling crane. The top of the wheel supply flat car has wooden blocking bolted permanently in place to keep wheels from rolling while in transit.

Those who feel that aviation is still of little consequence as an industry may be interested to know that one builder advertises that a plane leaves his plant every two hours, and that he expects to double this output in the near future. Every plane means at least one engine, one set of instruments and various accessories, the total value being greater than many realize. Those who fail to consider potential business in aviation are making a sad mistake.

The Price Per Pound

THE scene was Mr. Holland's city office, where he receives selected clients on those quiet days when he is not knocking about industrial plants on advisory jobs. T. E. Harris, president of a neighboring machine building plant, had come in.

"Why I have come here to see you, Mr. Holland, is this: Our engineering department has worked up a list of figures on estimating machine costs by weight, and I want to know what you think about the idea. You see, they've been trying to get me to make all preliminary cost estimates on a weight basis—they say our machines have been running pretty constant that way. Franklin, our chief designer, says about fifty per cent of the calls for bids are duds, anyway, and his men waste a tremendous amount of time on estimate work."

"Franklin has hit a sore spot in the machine industry, all right, Mr. Harris," mused our friend Bill Holland, as he clipped off the end of a cigar. "But I guess we'll have to leave that argument out of the discussion. It'll never be cured by offering half-baked estimates. What you want to determine is whether or not such estimates *are* half-baked, isn't it?"

"That's precisely the point, Mr. Holland."

"Well, it looks as if your engineering department is simply turning up a new phase of a very old subject, and maybe they've got something after all."

"What do you mean by old, Mr. Holland? Have other machinery builders used the plan?"

"Not so much in the machine line, Mr. Harris, though at one time it was talked a lot. Architects and builders have always used a cost per cubic foot for making rough estimates on big jobs. And ordnance engineers use something close to the cost per pound basis for advance estimates when they are out after appropriations.

"But sometimes a lot of costly design and close fitting goes into a machine that has little weight, and sometimes a lot of poundage goes into a machine that has a lot less brainwork. That's where one danger comes in, Mr. Harris, that the buyer may use your weight figures to compare with somebody else's machine, and it just can't be done."

"Then you think our engineering department figures are O.K., but don't compare with the other fellow's?"

"Yes, if used conservatively! Here's an English firm doing just that," said Holland, drawing a report from a file in his desk drawer.

"Look at this table they've made out. Compare the heavy horizontal miller with the small miller. Cost of material is about the same in both cases—roughly five cents a pound—but the 'rate for labor' is three cents per pound on the heavy machine and twenty-four cents on the other. Just the reverse on the turret lathe—eight cents a pound for the heavy one, and four cents for the small one. Probably that's due to the fact that they sell more small ones, and for that reason can cut labor costs by production methods."

"I begin to see, Mr. Holland. The cost per pound figures are great checks on our own shop costs, aren't they?"

"More than that, Mr. Harris. They serve to check the hasty estimates that come out of your engineering department. There's always the possibility of omission and under-estimating, so with past average cost figures you can get a fairly good check. They make a good tool for analysis, and sometimes for rough advance estimates. Only, like all good tools, they have to be handled by craftsmen. They're only good on similar work under similar conditions, and the product of one shop cannot be checked against the product of another with them."

"That gives me just what I need to get started, Mr. Holland. I'll get my engineers together this afternoon."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

EXECUTIVE FORUM

Discussion

How Much Overhead?

When the machinery of production becomes obsolete, we know the value of scrapping and replacing it with modern. When the machinery of management, such as the percentage of overhead based on direct labor, becomes obsolete, why do we show so much hesitation in doing likewise? Perhaps it is purely a matter of salesmanship—for the value of modern machinery is being established by a wonderful sales effort. Perhaps it is an indirect illustration of the value of advertising, for while the editorial pages of the technical press are advocating the advantages of changes in both production equipment and management equipment with equal force, there is apparently no one who will pay for display advertising for management equipment.

The man and the machine are linked together in modern mass production. It would be just as logical to have divided a man into so many parts, in the case of a pure hand worker, and charge only his hands to direct labor, all else being overhead, as it is to separate the man and the machine, charging one to direct labor and the other to overhead. A man's rate per hour is directly available, a machine's rate per hour based on interest, depreciation, estimated yearly use, etc., is not particularly hard to get. The sum of the two is an ideal basis upon which to figure overhead. Isn't it about time we do this, or else throw out the old conception of percentage overhead entirely, and attack the problem on a different basis altogether? —ROLAND GIBSON.

Making the Most of Floor Space

Before expending money on a new building, an investigation should be made of all the machines in use in that particular building. Upon investigation, it may be found that there are some machines that cannot be used for the purpose desired, or for any purpose. It is obvious that these useless machines are in the way of useful machines. They make operation difficult, obstruct moving of material, and otherwise retard the orderly, convenient running of the department. Getting rid of this useless equipment will reduce the hindrance to production and lower overhead charges in the department. Furthermore, more convenient access to the useful equipment will be obtained. —SAMUEL SOLOMON.

Instead of spending money for a new building, it would be a wiser move to make a survey of the general condition of the machinery in the plant, with a view toward eliminating useless equipment, and rearranging the machines to get a better flow of work through the shop.

In planning a rearrangement of machinery and equipment, good results are far more certain, if, upon a plan of the floor space, drawn to scale, templates or pieces of cardboard representing the floor space required for each machine, and drawn to the same scale, are shifted about until it is seen that the proper movement of work from machine to machine is secured. Other points to be considered are proper space for operators and for material being worked upon, the free movement of trucks, and space for work extending beyond the machines, as for instance, in cutting-off machines and shears. It is impossible to estimate the waste of time, the unnecessary effort, and the loss of money due to poor layout in the average plant. —J. GURWITCH.

Vacations and Bonuses

If a man has a purely routine job, where his production is automatically controlled by the speed of a machine which is unvariable as far as he is concerned, vacations and bonuses mean little. He either keeps up or gets out. But, to all others, they represent one of the best methods of investing money yet thought of. The cost of a week's vacation, if given as a raise, would often be so small when distributed over 52 weeks, that the employee's reaction might be unfavorable. But concentrated in one lump sum, it acts as a spur all through the year. If to this is added the further hope of a bonus, the picture is complete. The resultant speed up, new viewpoint, increased loyalty and desire to be a real part of the organization far exceed the investment costs. FRANK KAHN.

Interesting Men in the Shop

The only thing that seems to interest most men is, of course, their pay. Even that is not sufficient for everybody. Knowledge on the part of the men that they can expect to keep their jobs will go far towards keeping up efficiency. One thing that can only be used with part of the force is an encouragement to look for promotion. A statement from the superintendent to each person deserving it may affect the whole shop. When I worked in the shop, I was once very much pleased to hear my supervisor tell the superintendent in my presence that I was one of his best men. I think my effort increased at least fifteen per cent, although I previously had been working very hard. There is hardly any limit to what a man can do if the interest is there.

—A. E. FRISTEDT, *Sweden.*

The Metal-Working Industry Reports Its 1927 Profits

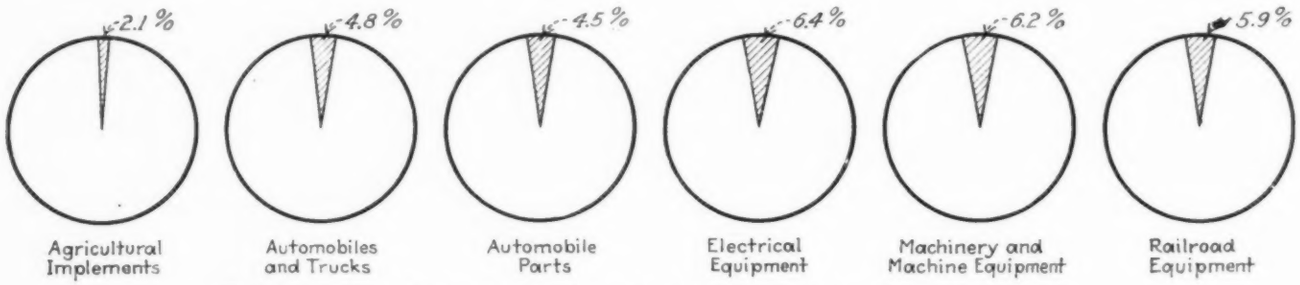
DATA are now available by which to compare the earnings of American corporations for the past three years. The Standard Statistics Company of New York has made a study of the statements of 650 large industrial and utility concerns and finds some trends which are of supreme interest to American industry as a whole.

This bureau finds that in the fact that 1927 business profits registered a substantial decline as compared with the year preceding there is nothing new to those who have been following the quarterly statements of these companies. The extent of last year's decline, however, becomes progressively more surprising. On the basis of reports of 455 leading corporations which had been made public up to the middle of April, the Bureau computed that the 1927 net total had declined 10 per cent as compared with 1926. Adding 88 reports which have since become available, brings the total 1927 decline up to 16.2 per cent. The fact that such a large decline in business profits should have taken place in a year which was generally conceded to have been a prosperous one is striking. Also that the extent of this decline should not have been known until some eight months after the close of the year reflects the fact that corporations which have the best results make these reports public promptly, while others are rather hesitant about displaying their unfavorable position.

The reasons given for this decline is net profits during 1927 are given by the Standard Statistics Company as four in number: The total volume of industrial output was smaller than in 1926; the trend of commodity prices was mainly downward; the margin of profits was smaller; and unsatisfactory and even acute conditions in some of the primary industries prevailed.

It must be remembered, however, that this rather large drop in the net profits was from an abnormally high level, and it is generally conceded that in spite of this drop under 1926, the 1927 profits were in general satisfactory to the investor. Only a few industrial concerns were unable to meet their regular dividend charges. Under such conditions, a drop in earnings assumes considerably less importance than it would assume at times when a decline of, say 12 per cent, might easily have created a situation of real distress.

The accompanying table gives a portion of the financial data of corporations operating in the metal working industry, as collected by the Standard Statistics Company, of New York. The data are not sufficiently complete to depict accurately conditions in the industry as a whole, but unit and group comparisons are possible. It appears that the profits of most of the groups of metal working companies declined during 1927, although the agricultural implement and electrical equipment groups show an increase. Practically all of the agricultural implement manufacturing companies reported substantial increases in income, although the yield to the holders of common stock was unusually low—only 2.1 per cent on the average, as against an average return for the 386 American industrials during 1927 of 5.2 per cent. The electrical equipment and machine equipment industrial group reported the highest returns of profit of the metal working industries. The yield in the machinery and machine equipment group averaged 6.2 per cent, one company reporting a yield to the common stockholders of 16.9 per cent, which was, however, far above that of any other company in the group, or, in fact, the entire metal working industry.



Relative yield to the investor in six major branches of the metal working industry

While the past year is interesting in determining trends, the profits during the current year are of current interest just at present. The outlook for the year 1928 as a whole, insofar as the metal working industry is concerned, is excellent. Prices and wages have remained on about a level with 1927, while the volume of operations in these plants for the first seven months of the year, as measured by the consumption of electrical energy in these plants, was about 15 per cent above that of the same period last year. The year 1928 should easily prove a record year in the metal working industry from a net earnings standpoint. That it will prove so from the machine tool builders' point of view is almost certain, as the volume of business done to date already exceeds that of last year.

We are very apt to credit the present generation with more of the advanced engineering practices than it deserves. Alloy steels are usually considered a new achievement, but chromium steel was used by Capt. Jas. B. Eads in biulding the famous Eads bridge at So. Louis, Mo., in 1868, sixty years ago, and it is still in excellent condition.

Earnings of Corporations in the Metal Working Industry 1925, 1926, 1927

(As collected by the Standard Statistics Company of New York)

Name of Company	Total Invested Capital $1,000	Income Before Fixed Charges 1925 $1,000	Income Before Fixed Charges 1926 $1,000	Income Before Fixed Charges 1927 $1,000	Earnings of Common Stock (Dollars per Share) 1925	Earnings of Common Stock (Dollars per Share) 1926	Earnings of Common Stock (Dollars per Share) 1927	Yield
Agricultural Implements								
Advance Rumely Co.	27,071	541	440	(a) 341	4.32	3.52	(a) 2.73	.....
Case Threshing Machine Co.	32,939	2,794	3,817	4,113	14.49	23.31	25.98	1.8
Caterpillar Tractor Co.	25,046	4,314	5,003	6,910	B 2.65	B 3.08	B 4.25	3.0
Deere and Co.	68,481	4,515	7,663	8,108	14.15	29.89	32.97	1.4
Emerson-Brantingham Co.	9,914	A (a) 916	(a) 298	(a) 592	(a) 8.26	(a) 2.69	(a) 5.33	.....
International Harvester Co.	258,481	20,129	24,089	24,746	14.89	18.44	18.83	2.1
Nichols and Shepard Co.	7,205	360	468	532	4.86	6.51	5.80	.....
Total 7 companies	429,137	31,737	41,182	43,476	.....	.....	.....	C 2.1
Automobiles and Trucks								
Chrysler Corp.	93,470	17,410	15,701	19,675	5.67	D 4.77	D 6.25	3.2
Dodge Bros., Inc.	108,912	E 16,499	25,413	13,441	B 4.04	B 6.46	B 1.55	.....
General Motors Corp.	860,180	116,016	186,231	235,105	7.00	10.27	12.97	5.1
Mack Trucks, Inc.	57,612	9,468	8,852	5,844	F 13.62	F 10.81	F 6.60	6.7
Studebaker Corp.	124,515	16,620	13,042	11,938	D 8.34	6.45	5.87	6.9
Willys-Overland Co.	70,007	12,110	2,498	6,820	G 4.36	Def.	D 1.74	5.5
Total 23 other companies	460,585	75,977	63,810	.....	.....	.....	.....	.....
Total 29 companies	1,775,281	264,094	315,547	.....	.....	.....	.....	C 4.8
Automobile Parts								
Briggs Mfg. Co.	28,517	8,142	8,179	1,156	4.07	4.08	0.58	.....
Continental Motors Corp.	34,794	3,378	2,569	1,756	1.60	1.15	0.71	6.7
Stewart-Warner Speedometer	26,865	7,544	5,109	5,210	12.47	8.42	8.63	6.5
Timken Roller Bearing Co.	31,679	8,088	9,854	10,222	6.73	8.21	8.51	3.9
Total for 22 companies	274,511	46,014	41,674	34,067	.....	.....	.....	C 4.5
Electrical Equipment								
American Brown Boveri Electric	26,382	1,740	B 396	B 579	3.95	B 0.05	Def.	.....
Electric Storage Battery	42,571	B 8,626	B 6,734	B 6,501	9.39	7.33	H 7.09	5.0
General Electric Co.	340,360	43,171	49,657	51,546	5.12	6.14	6.41	3.2
Westinghouse E. & M. Co.	205,435	16,590	18,365	17,141	5.96	6.81	6.59	4.0
Total for 6 companies	629,800	71,261	76,174	76,896	.....	.....	.....	C 6.4
Machinery and Machine Equipment								
Allis-Chalmers Mfg. Co.	55,584	3,417	3,597	3,182	F 8.78	F 9.39	10.03	5.5
American Machine and Foundry	19,842	I 456	I 896	I 1,515	I 1.81	I 3.81	I 7.11	16.9
American Type Founders Co.	30,240	1,174	1,309	1,118	14.90	17.15	9.88	7.3
Fairbanks Morse & Co.	35,753	3,016	2,989	1,984	G 6.74	G 6.03	G 3.09	7.0
Ingersoll-Rand Co.	43,149	6,197	7,928	6,601	6.00	7.73	6.40	4.4
International Combustion Engine	38,628	1,067	1,845	2,008	1.55	2.67	2.20	3.3
Mergenthaler Linotype Co.	24,800	2,699	2,625	1,803	10.55	10.25	7.04	6.0
National Supply	39,367	2,015	4,534	2,782	5.71	15.19	8.59	4.3
United Shoe Machinery Corporation	84,765	8,051	7,985	8,455	3.18	3.16	3.36	3.4
Worthington Pump & Machinery	25,490	529	366	600	Def.	Def.	Def.	.....
Total for 24 companies	519,958	37,189	44,217	36,962	.....	.....	.....	C 6.2
Railroad Equipment								
American Car and Foundry Co.	100,139	6,103	4,593	3,755	6.67	4.16	2.75	6.7
American Locomotive Co.	105,647	.....	8,016	745	.....	7.45	4.80	8.8
Baldwin Locomotive Co.	72,236	1,014	7,060	3,122	Def.	22.42	5.21	2.8
Westinghouse Air Brake	60,992	6,966	10,535	8,520	2.20	3.32	2.69	4.4
Total 13 companies	519,097	30,834	43,022	.....	.....	.....	.....	C 5.9
Grand Totals All Industries								
581 industrials	30,681,000	2,691,000	2,867,000	.....	.....	.....	.....	J 5.2
67 utilities	13,970,000	751,000	869,000	.....	.....	.....	.....	K 4.3
46 railroads	20,504,000	1,242,000	1,263,000	.....	.....	.....	.....	L 4.9

(a) Deficit; A—Earnings predecessor companies; B—Before taxes; C—Average; D—After deferred stock sinking fund; E—Eight months' report; F—Prior security issues outstanding which have since been redeemed; G—Before preferred stock sinking fund; H—After estimated taxes; I—Excluding subsidiary companies; J—Average 386 companies; K—Average 45 companies; L—Average 28 companies.

· BOOK · REVIEWS ·

INFLUENCING MEN IN BUSINESS. By Walter Dill Scott, president of Northwestern University, and Delton T. Howard, Ph.D., associate professor of psychology and director of personnel, Northwestern University. One hundred and seventy-two pages, 5½x8½ in. Cloth board covers. Published by the Ronald Press Company, New York, N. Y. Price $2.50.

AS A contribution to the psychology of business, aimed particularly at selling and advertising, this book is of equal value to all "whose interest is in influencing men rather than in handling things," and Professor Howard has revised and enlarged it for a third edition.

The author tells us that all methods of influencing men may be classified either as argument or as suggestion. He goes on to state that logic can tell us how men respond, when they respond logically, but men's reactions are frequently anything but logical. In moving and in inspiring men, suggestion is to be considered as in every way the equal of logical reasoning. The two methods are analyzed and compared in detail. The entire last half of the book is devoted to the matter of when to use arguments and when suggestions, and how to make each effective, the latter being illustrated by eighteen full-page reproductions of advertisements.

MACHINE SHOP UNIT, Part I. Edited by H. C. Thayer. Twenty sheets, illustrated, 8½x11 in., paper cover. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price 35 cents.

THIS BOOKLET, which deals with lathe operation, has been prepared for vocational schools as an aid in teaching basic trade processes. Information and process sheets both are included, the information sheet outlining the correct method of performing a specific operation, and the process sheet showing how the actual job should be carried out. The process sheets also have review questions pertinent to the operations discussed.

Twelve processes are included, these being: Facing and squaring; straight turning between centers; locating and drilling center holes; drilling in the lathe; external thread cutting; taper turning; chucking a job in a lathe; knurling; shoulder turning; layout work; boring in a lathe; and filing and polishing in a lathe. The sheets are not intended to substitute for the teacher, but they can help to make good teaching more effective.

STANDARDS AND STANDARDIZATION. By Norman F. Harriman. Two hundred and sixty-five pages, 5¾x9¼ in. Cloth board covers. Published by the McGraw-Hill Book Company, New York. Price $3.

MR. HARRIMAN has given us a concise account of the more important elements of standards and standardization. It is claimed to be the first book in the English language, up to the present time, on this important subject.

The first major section of the book is devoted to standards, the second to standardization, and the third to national standardizing bodies and national and international standardizing laboratories. Following these come a chapter on the trend of standardization, an appendix on standardization and co-ordination of government purchases, and a bibliography. The chapters on standardization are of particular value to everyone interested in management. The principles are set forth in a broad manner from a scientific, technical, and economic viewpoint.

This is the first volume in the McGraw-Hill Industrial Management Series, of which Dean Dexter S. Kimball, of Cornell University, is consulting editor. The series will include fourteen volumes, covering the fundamentals of modern industrial management. The type of experts chosen as authors of this series is shown by the following which describes some of Mr. Harriman's activities: senior engineer-physicist of the National Bureau of Standards, member of the American Engineering Standards Committee, vice-chairman of the Federal Specifications Board, and member of the Federal Purchasing Board in the Bureau of the Budget.

PRINCIPLES OF VALUATION. By John Alden Grimes and William Horace Craigue. Two hundred seventy-four pages 6x9 in. Indexed. Cloth board covers. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York, N. Y. Price $10.

THIS book is a thorough treatise on the important subject of valuation by two United States Treasury valuation engineers. It describes several methods of income valuation, and discusses the advantages and disadvantages of each. All aspects of the mathematical principles of valuation are covered, and also the interrelation of the mathematical premises of valuation. It is divided into seven chapters, and is well illustrated with charts and many tables.

The book shows what acceptable methods can be used to value income of lands, natural resources, capital goods, franchises, patents, and good will. The authors present four methods used in establishing sinking funds, and also illustrate how to determine the "discount for hazard" or safety factor on future incomes which are subject to high speculation.

Complete and detailed arithmetical illustrations of the application of all principal types of valuation fomulas are also provided, showing the division of each year's income between payment of interest and retirement of capital. The appendix contains valuation tables for every percentage from 3 to 20 per cent, and every fifth percentage from 20 to 100 per cent.

WAGES IN THE UNITED STATES. This book is the fifteenth of a series in which the National Industrial Conference Board gives the results of investigations on the subject of wages, hours of labor, and employment in industry. It contains one hundred sixty-eight 6x9-in. pages, and is profusely illustrated with comparative charts, and also contains numerous tables of wages in various industries for the years from 1914 to 1927. The book is a very comprehensive analysis of the wage situation in the United States, and shows the after-the-war development as compared with 1914. Besides the manufacturing industries it takes up building trades, anthracite mining, agriculture, and the railroads. The book, in cloth binding, can be obtained at a price of $2.50 from the National Industrial Conference Board, Inc., 247 Park Ave., New York.

According to the Bureau of Foreign and Domestic Commerce, a total of 87 airplanes were exported in the first six months of 1928, as against 63 during the whole of the previous year.

What They Talked About on the "Cincinnati"

Symposium on Machine Tools—Their Use and Application in Modern Manufacturing Methods

Machine Tools—Their Use and Application in the Railroad Industry

By L. A. North
Shop Superintendent, Illinois Central System

AT THE present time the number of parts for locomotives as well as the weights are increasing constantly, and it is necessary that new ways, new methods and higher production be established to maintain reasonable costs. The most essential element in the application of machine tools in railroad shops is securing the greatest production with the minimum of labor costs, taking into consideration the cost of changes necessary to bring about this condition.

The attitude of the railroads toward the introduction of new tools and new methods can be shown by their use or application for grinding, milling, drilling, turning from bar stock, and lapping and honing. To some extent internal and external grinding has been developed in railroad shops, and is being advanced still further by new machines designed to meet the requirements of new operations and practices. Many parts formerly turned, planed or slotted are now finished in a far shorter time by grinding. Air reverse cylinders, air fire-door opener cylinders, grate-shaker cylinders, stoker engines and numerous other pieces of equipment can be taken care of by this method. The solid-end main rod or adaptor can be trued on the inside in this way with far less cost, and a smoother running surface can be produced.

Solid side-rod holes elongated in service can be brought back very readily and cheaply to a perfect diameter. Crank pins and driving axles can also be handled economically. Some thought has been given to tire grinding, and also some experimental work has been done on reducing flat spots on car wheels. The grinding of locomotive cylinders and piston-valve bushings would furnish a smoother surface than the present method. The removal of all abrasive matter after the work has been completed is necessary, of course, and a very stiff arbor would be required to eliminate springing in order to insure a straight bore. The necessary alignment for the valve chamber bushings in order to secure friction reduction and smoother operation of the valve gear controlling the valve, would make it necessary to do this class of work with the bushings in place.

Milling machines are taking a prominent part in railroad shop practices. Further development can be made, and production can be increased and cheapened by a closer study of railroad shop needs, keeping in mind the introduction of harder and tougher metals used in locomotive construction. As illustration of these, chrome-vanadium steel is used in side and main rods, as well as in motion work today.

Drilling operations in railroad shops are performed on the full radial, semi-radial, multiple-spindle and the vertical types, although very little use is found for the full radial. Formerly drill presses were used for cutting out solid sheet now done with the "Oxy-Graph." Multiple-spindle drilling machines are used for drilling firebox sheets, the gain of time over punching being very marked. With such a machine one operator can greatly increase production of such work as spring rigging and small bushings.

In turning from bar stock, close study is required in order to avoid wasting material that otherwise would be saved if more laborious methods were used. The time reduction with bar stock machines has been very marked, this reduction amounting to at least 10 per cent, it is believed. Among developments is the chucking feature which enables the operator to turn bolts that have been made in the bolt-heading machine, and a taper attachment which permits the turning of taper-fit bolts in a much shorter time than by turning on lathe centers. Special chucking features have also been added to other machine tools, such as heavy-duty boring mills. Forming tools used in conjunction with high-speed tools, and specially designed heavy-duty machines have brought about reduction in machining time, and have enabled the locomotive shops to keep pace with the increased areas and weights of parts to be machined. At the present time on railroad work, lapping and honing are only used on airbrake parts. Some improvements have been made over the hand methods, particularly in repairs to triple valves and other small parts which can be handled on a production basis.

Machine Tools in the Implement and Tractor Industries

By Max Sklovsky
Chief Engineer, Deere & Company

GREAT strides were made in the application of machine tools in implement factories between the years 1880 and 1900. Such machine tools were of special types designed for rapid production purposes. Between 1900 and 1915, standard machine tools were introduced to a greater degree. This was due primarily to the development and introduction of high-speed steel. The period since 1915 has seen the further introduction of machine tools in implement manufacture, which has been due in part to the development of machine tools for a great variety of specialized purposes.

Prior to 1880, the number of machine tools used for

Abstracts of the papers presented at the second national meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers, held September 27-29, on the night boat "Cincinnati" and at Cincinnati.

production purposes was less than one such machine for every twenty employees. These were nearly all drill presses and represented an investment per employee of about $10. Since 1915, the number of machine tools has been about one machine tool for every six employees, and the investment is $200 per employee.

The development of the tractor for extended use on the farm began about 1905. The early tractors were built according to tradition, and strict interchangeability was not obtained, nor did the production quantities at first warrant it. A strong demand for light tractors of refined design soon led to the introduction of the methods prevailing in the automotive industry. It became necessary for tractor manufacturers to develop machine tools of their own, and some of the problems connected with this process of development are of interest to all machine tool users.

Machine tools for tractor production should be able to produce tractor parts rapidly and accurately, and to continue such production uninterruptedly. They must also be built with factors of rigidity and strength far beyond the standards of a decade ago. Furthermore, the wearing surfaces must be ample, so as to avoid noticeable wear. And when wear does occur, the design and construction of such tools must permit of prompt and quick readjustment or repair. Protection of wearing parts, principally the various bearings, and the lubrication of the same, are the two factors essential in good machine tools today. Interchangeability of wearing parts is more desirable than any repair of such parts, and on this account ball or roller bearings properly adapted are preferable to solid bearings. Dependence on lubrication by the machine operators is not sufficiently reliable; hence, automatic machinery should include automatic lubrication.

Rigidity of Joints Overlooked

Rigidity of machinery, where chiselling tools are used, is universally recognized as essential, but many designers, unfortunately, have overlooked one element of rigidity, namely, that of joints. Parts of machine tools are designed most generally with sufficient rigidity, but the fastening of these by means of bolts or studs is usually insufficient, and the factor of rigidity of a joint is very frequently 1/50th part of the factor of rigidity of the remainder of such a machine. Chatter is the most serious drawback in obtaining proper results from the machine tools.

The recent rapid growth of the tractor industry has been due mainly to the development of tractors to suit the purposes of agriculture. In the tractor industry of today, the machine tool investment per employee is about $1,500, or 7½ times as great as in the implement industry.

The extensive use of tractors today and the likelihood of greater increase in their use is resulting in the modification of the implements that are used in connection with tractor operations. The rougher methods of manufacture applied to implements are being modified to give greater precision and greater strength. The speed of the tractor and the excess power that it provides require that implements attached to tractors be designed to withstand the increased stresses without excessive wear. Machined steel parts in place of castings and cut gears in place of cast ones then become necessary to provide greater strength, and ball and roller bearings become necessary to provide increased resistance to wear. All these changes call for increasingly careful machining, and the tendency now is, and will be to a much larger extent in the future, to apply machine tools to a greater degree in the manufacture of implements than has been customary heretofore. Precision of manufacture will apply not only to the tractor, but to the implement as well. Inherently, implements however will require forging machines rather than machine tools.

Some Practices in the Use of Machine Tools in the Electrical Industry

By J. R. Weaver

Shop Superintendent, Manufacturing Equipment Dept., Westinghouse Electric & Manufacturing Company

OWING to the necessity of meeting special requirements of the customer, work in the electrical business is so diversified that standard machines with special holding fixtures are used extensively. Often several machines are operated in sequence by one operator, and although this system may not increase production, it will reduce the cost because one operator is operating several machines. Semi-automatic and automatic machines are usually grouped. With equipment having controlled feeds and rapid power traverse, it is surprising how well machines of this type adapt themselves to multiple operations.

Wherever sufficient economies can be realized, special machines are installed which are purchased from machine-tool builders or designed and built by ourselves. We also have certain operations that cannot be done on machines that are on the market, and these we have to build ourselves.

Although we believe that fixtures should be designed and built by the manufacturer of the machine tool and installed on the machine while it is being built, we find it quite inconvenient in that it extends the time of delivery of the machine. Owing to misunderstandings that oftentimes arise, it is usually advisable to build our own fixtures. However, we try to take advantage of machine tool builders' experience.

We have been carrying on various studies of planing versus milling on our products, especially on larger work. We find on some work, especially on form surfaces, that planing is much more economical than milling for the reason that we can maintain form and size with the least expenditure. However, on flat surfacing, especially where there are a lot of pads to be finished, it is believed that the milling machine is better adapted than the planer.

We do considerable surface grinding on castings, and we find this to be a very economical way of finishing surfaces, providing there is not more than ¼ in. of metal to be removed. This includes both iron and steel castings.

Welded Steel Construction

We are going quite extensively into welded fabricated steel construction on our apparatus, which is reducing our machining time considerably, and the thought occurs that it may be possible, to some extent at least, to apply the same construction to machine tools. We have gone into this construction on our jigs and fixtures very extensively, and find that we have not only reduced costs, but have shown an advance in delivery of three weeks on each jig.

We have been experimenting with the chromium plating of cutting tools quite extensively, and on materials other than metals we have had very good success. When cutting steel and cast iron, however, we find that the plating chips off at the cutting edge.

In order to reduce machining, we have resorted to the process of die casting, permanent molding and hot press-

ing. Die castings are made in our shops from zinc-base alloys and aluminum, while castings made in permanent molds are composed of iron aluminum bronze, or aluminum alloy. Hot pressing in our shop is performed on brass and copper. We have been working for some time with closed dies for some of this work, and have had very good success, depending of course on the size and shape of the piece. Where the forging required is thin, we find that the flash die is necessary.

Inspection Methods and Quality Control in the Manufacture of Aircraft-Engines Parts

By Hugh W. Roughley
Quality Manager, Wright Aeronautical Corporation

FROM the time the raw material enters the Wright factory until the finished engine is finally tested and packed for shipment, all raw materials and every operation in the process of manufacture is subjected to the exacting scrutiny of a large force of specialists. Bar stock and forgings, which will meet chemical and physical requirements, are carefully inspected upon receipt. Tensile test pieces are made on each lot of material to insure the physical properties called for. Each accepted bar is stamped with specification number and lot number on each end, and, in addition, is painted its entire length with a color combination.

Inspection of forgings is carried out along similar lines. Previously, however, inspection has been carried out at the forge shop. In the case of crankshafts, the first shaft off the dies is sectioned through its center line and deep-etched to show structure. The flow-lines are then studied by the metallurgical department. After heat-treatment, each forging is given a serial number and is brinelled on each end and in each cheek. The portions are polished and carefully examined under a high-power microscope in order to determine that the shaft has been properly heat-treated. A photo-micrograph is then made and filed with the record of each individual shaft. After final inspection for dimensions, the shafts are again carefully inspected with a magnifying glass. A record is kept on file in the inspection department office showing the engine number, the serial number of the crankshaft installed therein, and the complete history of the shaft from the time it was forged.

Steel for connecting rods has the same requirements as that for crankshafts, and the rods are given the same inspection at the forge shop. After rough machining and heat-treatment, they are again inspected and physical tests are made. Rocker-arm forgings are carefully inspected for any imperfections, and given 100 per cent hardness test before being finish-machined and finally inspected for imperfections on the finish surfaces.

Numerous small parts having a hardness of about 350 brinell are machined from annealed bar stock, heat-treated, and finally given a 100 per cent test for hardness, a representative number of tests being made. This procedure applies alike to gears, push-rod ball ends, washers, and special studs.

All aluminum and bronze alloy castings are stamped with the heat number. Some, not requiring heat-treatment, are tested each day in the "as cast" condition. All heat-treated castings are again given physical tests.

During manufacture, each piece is checked by an inspector who is familiar with the particular operation before an operator is allowed to proceed with the remainder of the order. Quality standards are checked from time to time on all machines. Any parts found defective on floor inspection are rejected and delivered to the salvage department. A number of major parts, such as crankcase sections, receive 100 per cent inspection on each operation. Upon completion, each engine part is thoroughly washed and cleaned, and sent to one of several final inspection cribs, where it is given 100 per cent final inspection. Each acceptable piece is stamped by the inspector, and then sent to stores. After assembly, each engine is given a performance test, and then is disassembled and examined for defects. The engine is then reassembled and, after final test is ready for shipment.

Symposium on Lubrication of Plain Bearings

Grooving Bearings in Machines

By G. B. Karelitz
Research Engineer
Westinghouse Electric & Manufacturing Company

INDISCRIMINATE cutting of grooves in a bearing may be harmful. The function of grooves is primarily to distribute oil from the source of supply over the complete length of the bearing. They must, wherever possible, he confined to the unloaded portion of the bearing; the loaded part should be left free from interruptions. It appears that an angle of about 45 to 60 deg. must be had between the line of oil admission and the load line to allow building up an efficient load carrying oil film.

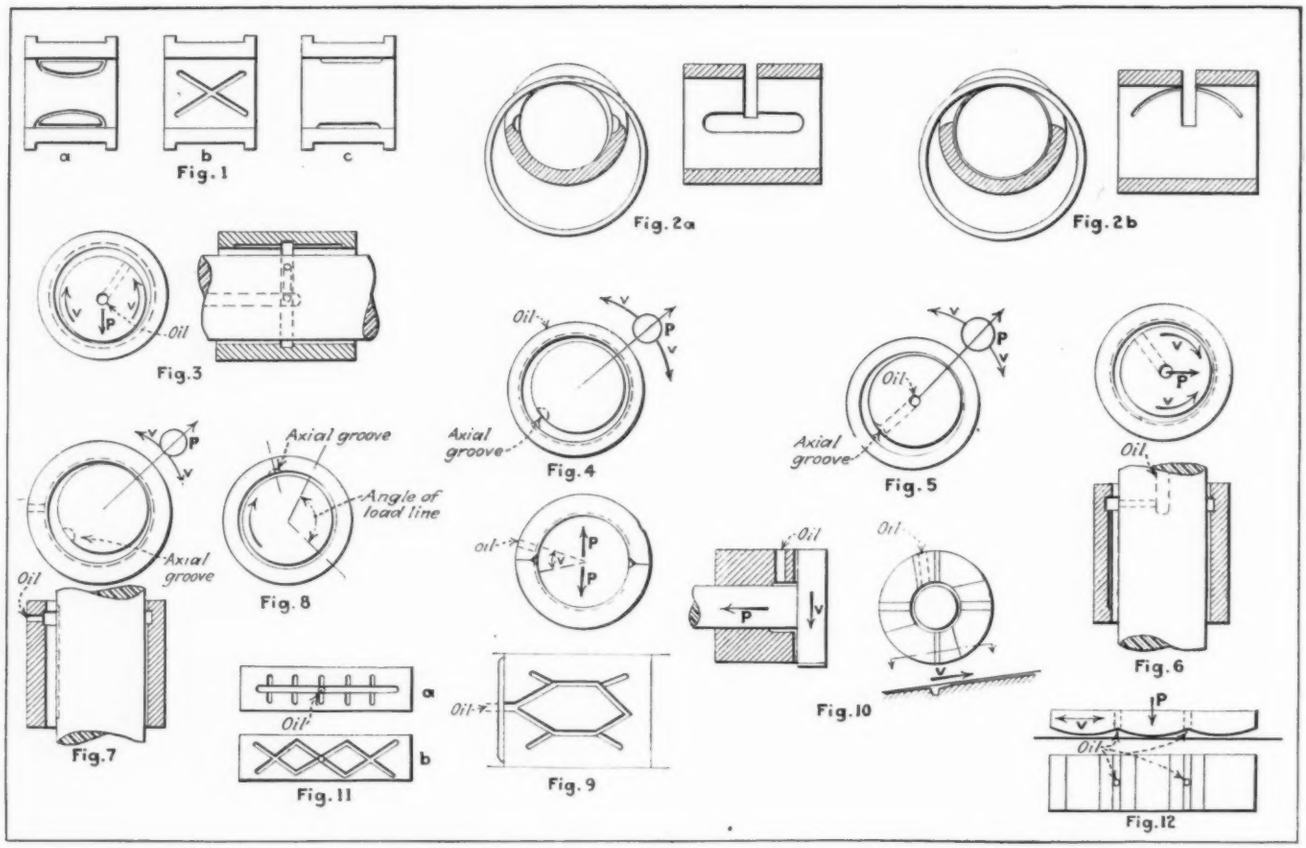
Bearings are classified by their motion and by the character of their loading.

A. Horizontal Bearings, Rotational Motion.

1. Steady Load. Fig. 1 shows three bearings with grooves quite often met with in practice. Grooves of type *a* are useless, as they do not add anything to the effectiveness of the bearing, increasing, however, the cost of the manufacturing. Grooves of type *b* are simply harmful, being cut in the pressure zone of the bearing. Those of type *c* are properly designed.

Where an oil ring is used, the load acting downward or inside the lower 60-deg. segment, the groove is conveniently made as in Fig. 2*a*. The grooving arrangement of Fig. 2*b* is preferable where the load line lies at an angle above 45 deg. to the vertical center line. Should the oil be supplied by forced feed or drop feed, the lubricating hole is located at the midlength of the bearing. The hole opens into an axial groove distributing oil along the bearing. Lubricant may be supplied to the bearing through the journal as in Fig. 3. It is best then to divide the bearing in two by a circumferential groove into which the oil hole opens. The oil is further distributed by an axial groove. In the case of a stationary shaft and a rotating bearing, the lubricant is conveniently supplied through ducts in the shaft. The lubricating hole is placed on the no-load side and opens into an axial groove that is cut in the shaft, and which distributes the oil along the bearings.

2. Direction Variable Inside a Certain Angle. These arrangements mentioned previously are suitable also for the case of load of variable angle, providing



there is a sufficient angular space of about 45 deg. between the axial groove and the extreme load line.

3. Rotating Load. An axial groove is cut in the shaft on the no-load side, as in Figs. 4 and 5. The oil supply may be effected by an oil ring or through an oil hole. The oil-ring method is inferior in the case of a rotating load. Should it be necessary to feed oil through the shaft, the construction of Fig. 5 may be employed. With the shaft stationary and the bearing rotating under the action of a rotating load, the oil hole in the shaft opens into a circumferential groove cut in the shaft or in the bearing. The location of the hole is at the midlength of the bearing.

4. Direction of Load Indefinite. Should there be no indication at all in what direction the load on the bearing may be expected, an oil-ring bearing of either type *2a* or type *2b* may be employed. With drop feed or with forced feed, it is advisable to provide a circumferential groove at the center into which the oil hole opens, the groove being cut in the bearing or in the shaft. Should the lubricant be applied through the rotating shaft the oil hole opens at midlength of the bearing into a circumferential groove in the shaft or in the bearing. With a stationary shaft and a rotating bearing, the grooving is the same.

B. Vertical Bearings for Continuous Rotational Motion.

1. Direction of Load Known and Constant. An axial groove is cut in the bearing on the side opposite the line of action of the load. The lubricant is applied through an oil hole opening into the groove at a point near the top of the bearing. Should the lubricant be fed through the vertical running journal, the oil hole opens into a circumferential groove at the top of the bearing, an axial groove being cut on the side opposite to the load line, as in Fig. 6. With a stationary shaft and a rotating bearing, the oil hole in the shaft opens into an axial groove cut in the journal on the no-load side. The location of the oil hole is near the top of the bearing for drop feed, or at the midlength with forced feed of an appreciable pressure.

2. Direction of Load Variable Inside a Certain Angle. The considerations brought forth in the discussion of the corresponding case for horizontal bearings hold also for vertical bearings. The axial groove must be located in such a way that the extreme direction of the line of action of the load will not come nearer, as shown in Fig. 8, than 45 deg. to the groove on the down side of the bearing.

3. Rotating Load. Fig. 7 shows the application of lubricant to a bearing where the load rotates together with the journal. The oil is fed into a circumferential groove at the top of the bearing, while an axial groove is cut in the journal on the side opposite the load line. The same arrangement with the circumferential groove at midlength of the bearing, is more suitable for forced-feed lubrication. In the case of a stationary shaft and a rotating bearing, the lubricant is applied to the shaft. An oil hole opens into a circular groove in the bearing or in the shaft. An axial groove in the bearing is cut on no-load side.

4. Guide Bearings. In vertical bearings serving as guide bearings, the direction of the load is, generally speaking, indeterminate. In this case the lubricant is supplied into a circumferential groove in the bearing, at its top, or at midlength for forced feed. If lubricated through the journal, the oil hole opens into a circumferential groove cut in the bearing, no axial grooves being

provided. This arrangement is satisfactory also for the case of a stationary shaft and rotating bearing. In both cases the groove would be operative as well when cut in the journal, thus leaving a smooth cylinder for the bearing surface.

C. Bearings With Oscillatory Motion.

The mechanism of lubrication of bearings with oscillatory motion depends on the character of the load acting on the shaft. This may have a constant or intermittent direction of action.

1. Direction of Load Constant. The lubricant is applied to a circumferential groove at the midlength of the bearing, while several axial grooves distribute the lubricant over the bearing surface. The lubricant may be fed through the shaft into the central groove.

2. The Direction of Load Is Reversed During Oscillation. The grooves must be arranged to insure an easy access of lubricant to the rubbing surfaces of the bearing when these are parted during the no-load phase of the bearing cycle. The shaping of the groove must also take into consideration the prevention of air penetrating into the bearing clearance. A system of diagonal grooves into which the lubricant is applied seems to be advisable in this case, as in Fig. 9. Grooving as in Fig. 9 is advisable also in the case of a bearing transmitting forces reversing periodically in direction, without any rotation of the bearing. For a stationary shaft with an oscillating bearing, the lubricant is supplied through the shaft. Two opposed oil holes open into axial grooves on the shaft, the bearing having no grooves at all.

D. Thrust Bearings. Ordinarily, small thrust bearings are made in the shape of a collar ring mounted on the arbor. It is clear that a load-carrying oil film cannot be built up between the collar and bearing, since the two surfaces move parallel to each other. There is no reason why simplified Kingsbury elements could not be introduced in small thrust bearings. The application is shown in Fig. 10. Several radial grooves are cut in the thrust bearing, lubricant being fed into these grooves through an oil hole. The grooves are developed into inclined planes blending smoothly with the bearing surface. The shaft collar must be of a width approximately equal to the distance between adjacent grooves. By developing inclined planes on both sides of the radial grooves, a bearing operated in both directions of rotation can be obtained. A bearing able to take up thrust in both directions is obtained by mounting thrust bearings on both sides of the shaft collar.

The motion of guides being generally of an oscillatory character, the remarks concerning bearings with oscillatory motion hold also for grooving guides with rectilinear motion. Two different cases may be considered: (1) When the forces acting on the guide bearings do not change their direction throughout the motion; and (2) when the forces reverse their direction with the reversal of the motion of the guide.

Should the forces change their direction, fluid lubrication may be obtained by allowing the clearance between the shoe and the guide to be filled with lubricant during the no-load phase of the cycle. The grooves may be arranged as shown in Figs. 11*a* and 11*b* in order to secure an easy access of the lubricant to the shoe surface during the no-load phase of the cycle.

With forces steadily pressing the shoe surface to the guide surface, grooving is insufficient to provide a load-carrying film. If the movement of the shoe is of considerable magnitude, the shoe may be supplied with a number of inclined planes. This is advisable only when the movement is considerably larger than the length of one element of the inclined planes. Fig. 12 shows such a guide shoe, which is arranged to provide a floating action for both directions of motion. It will be noted that the inclined planes must be cut at a very small angle, and a large radius must connect them with the surface of the shoe.

A Theory of the Lubrication of Cylindrical Bearings

By F. E. Cardullo
Chief Engineer, G. A. Gray Company

THE theory developed applies to cylindrical bearings completely filled with fluid lubricant that wets both the journal and the box, which are not concentric. Since the space into which the lubricant is carried from the groove by the revolving journal becomes steadily thinner, the film is compelled to spread out and flow endwise along the bearing. Back pressure is set up by this axial flow to support the journal.

Formulas, among others, are derived for: (1) The mean axial velocity of lubricant at the ends of the box, (2) the hydrostatic pressure at any point, and (3) the allowance for running fit.

It is shown that the curve of pressure distribution at any plane perpendicular to the axis of the journal is a function of the eccentricity. The amount at which the centers of the journal and box are offset when expressed as a fraction of one-half of the running fit is known as the eccentricity. For high values of eccentricity, the maximum pressure may be many times the mean pressure. In the illustration is shown the relation between the pressure and distance along the axis of bearings 2, 4, and 6 in. in length. It will be noted that the load carrying capacity increases very rapidly with the length. Referring to the figure, if two circumferential grooves are cut at points 2 and 2′, the capacity will be reduced to the area under the three curves 3*E*2, 2*B*2 and 2′*E*′*B*′. Therefore it is desirable to cut the circumferential grooves as close to the end of the bearing as possible so that the effective length will be at a maximum.

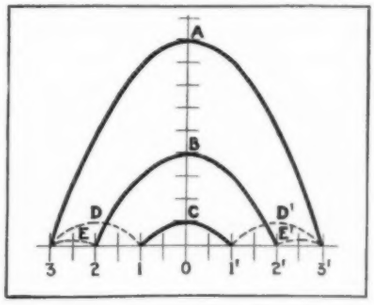


Chart showing the hydrostatic lubricant pressure at various points on bearings of 2, 4, and 6 in. in length

The author states that the running clearance may theoretically be three times the allowable film thickness. In general, however, longer bearings should have larger operating clearance than shorter bearings. For bearings of the usual speeds and diameters we may take for the minimum value of the allowance for a running fit:

$$2c = 0.0001\sqrt{D \times \text{r.p.m.}}$$

where $2c$ = minimum allowance for running fit
D = diameter of journal, in.

Sixteen rules have been deduced by the author from the theory and the physico-mathematical analysis pre-

sented. The first four rules state that the load-carrying capacity is proportional to:

1. The diameter of the bearing
2. The operating viscosity of the lubricant
3. The speed of the rotation of the journal
4. The surface speed of the journal

5. The load-carrying capacity of a bearing is a function of its length. For very short bearings such as eccentric straps, it is proportional to the cube of the length. For very long bearings it is proportional to the length. For bearings of the usual proportions, the load-carrying capacity is proportional to some power of the length greater than the first and less than the third.

The power loss in a bearing depends upon the eccentricity ratio. With the same operating clearance, operating viscosity, and speed, a bearing with a high eccentricity ratio will have a greater power loss than one with a low eccentricity ratio. If we assume that this ratio remains constant, we arrive at the following general rules for the power loss: It is proportional to the square of the diameter; to the length; to the square of the speed in r.p.m.; and to the square of the surface speed of the journal.

It is inversely proportional to the operating clearance, but is proportional to the operating viscosity of the lubricant.

The above rules lead directly to the following conclusions regarding the ultimate rise in temperature of a bearing operating continuously:

It is independent of its length.

It is proportional to its diameter; to the operating viscosity of the lubricant; to the square of the speed; and to the running clearance.

Notes on Machinery Finishing

By E. Perry

ONE of the most important features to consider in machinery finishing is the preparation of the surface, which should be free from rust and oil or grease. In the larger factories, where the equipment is available, rust is most completely removed by sandblasting, but where the equipment is not at hand, good results can be accomplished by means of wire brushes and the various abrasive cloths. The removal of rust should be followed by the washing off of all oxides, using benzine, or preferably a mixture of three parts of benzine and one part of wood alcohol.

For finishing machinery and parts by painting, the primer advised for a first coat on the bare metal is the type supplied ready for use on automobile bodies, and the consistency is applicable to both brushing and spraying methods. Brushing is preferred for machinery, in order to insure working the primer well into the pores of the casting and around such projections as bolt heads. A primer of this type is tough and elastic, adheres well, and is an excellent foundation for binding subsequent coats. Moreover, it has the advantage that it will dry completely over night.

An alternative material much in favor in many machinery building plants is a surfacing primer having a stronger pigmentation. As its name implies, it is a combination possessing a specially prepared vehicle affording the tenacity of a separate primer, and also possessing filling properties. It does not have to be reduced for spraying, and atomizes well in the spray. It also dries over night, and levels perfectly so that it requires only a minimum of sanding down preparatory to a second coat.

The next coat, which would ordinarily be the filler or the surface coat, should be an application of the surfacing primer already described. This material would be used as the next coat over the primer, or, in the alternative process, it would be the second coat of the same material. This latter method produces a better job in less time. It can be surfaced down with fine paper or pumice block and water. Castings that are uneven and porous or pitty will require the usual filler in paste form to be knifed or strapped on, and after drying, to be surfaced free from ridges. A partial filling may be done and roughly sanded down, after which a full coat of the surfacing primer is applied and the whole job smoothed out for the next sealer coat. In brush work on these materials, each alternate coat should be crossed, or brushed at right angles to the preceding coat. This will eliminate ridges, and make a level surface.

The sealer is offered generally in black, red, maroon, green, and gray, and it thus acts as a ground coat to bring out the full shade of the finishing color, as well as doing a primary job of rendering the surface nonporous. Any sanding of this coat must be carefully done with very fine finishing paper to avoid cutting through. Any cutting of this coat will produce a non-uniform final finish.

The finishing coat may be either the customary oil-proof paint, producing a half-flat or velvety finish impervious to the action of lubricating oils, or any of the gloss machine enamels. If the machines are to be tested, this testing should be done prior to finishing, and before the sealer is sanded. Following the testing, any oil on the surface should be removed with benzine.

Pyroxylin enamels and paints can be used for any finishing coats, but pyroxylin sealer is only applicable under favorable conditions, as it is well known that pyroxylin lacquer does not adhere well to steel, especially if the surface is oily or dirty. The interior pockets of castings, used as reservoirs for lubricating oil in the finished machine, should be sprayed with an oil-proof material to seal the pores of the iron, and also to resist the action of cutting compounds.

Making Pencil Tracings—*Discussion*

By John D. Riggs

I WAS interested in reading the letter of Albert Conway on making blueprints direct from pencil tracings, on page 243, Vol. 69, of the *American Machinist*. This practice has become quite common in the Middle Western states, especially for tools and fixture drawings, and on work which will probably never be used but once. However, it seems that there is a general tendency to overestimate savings effected, for the draftsman must put more work on a pencil drawing that is to be used for a satisfactory print than he would if the drawing were to be traced. In any case it is well to remember that the large item in the cost of drawings is the cost of finding out just what to draw.

Inspection Methods *and* Their Application

Fig. 91—Micrometer fitted with a dial indicator

By Fred H. Colvin
Editor, American Machinist

PISTON inspection gives opportunity for using a large variety of gages, each shop usually having some of its own design. Dial gages are commonly used in many combinations. A dial micrometer, used by Graham-Paige for measuring the diameter of the piston skirt is shown in Fig. 91. Four other piston inspection gages are shown in Fig. 92. The gage at the left, with its five dials, checks the diameters and concentricity of the lands, the concentricity of the skirt and the squareness of the piston-pin hole. The test plug is not in the hole, but it can be seen how the contact point of the right-hand gage would show the position of the pin at each end as the piston is turned 180 degrees.

The next one is a double-ended feeler gage for ring grooves. The piston at *A* is held on one of the gages that slips into the groove; the other end is the no-go gage. In these days, when quietness is such a factor, even ring-slap is looked after very closely. The widths of the ring grooves and those of the rings are held to very close tolerances.

The third gage checks the thickness of the piston head. Putting the piston in the V-block shown and against the end stop, the rod *B* is pushed inside until it bottoms against the head. The disk on the end contacts with the dial gage, and shows whether or not the head thickness is correct. The total length of piston is checked in the fourth gage at the right in a very simple manner. Two gaging operations for piston heads are shown in Figs. 93 and 94. One is checking the diameter of the lands between the ring grooves, and the other the grooves themselves. Fig. 95 shows a group of three operations, each checking a special dimension on the piston. On the bench is a special gage for testing the distance between the piston-pin hole and the head, as well as the squareness of the hole. These inspections are all from the Chrysler plant. In this plant careful attention is paid to ring inspection.

Fig. 96 shows the type of gage used in checking the thickness of the rings. Hardened steel disks with spacing pieces of proper length form go and no-go gages that are easily used. The roundness of the rings is checked by the device shown in Fig. 97. Here the ring fits a collar, being seated in a narrow annular recess. Springing the ring to be tested into the recess shuts out the light from an incandescent bulb beneath providing the ring is round. If it is not round, the light showing between it and the collar permits even a slight variation from roundness to be easily detected. The light is prevented by a diaphragm from showing through the bore of the ring.

In the Hupp plant, piston-head thickness is tested by the depth gage in Fig. 98. The dial indicator is inverted and an arm on the measuring plunger carries a rod that contacts with the indicator spindle. Squareness of the ring grooves is tested as in Fig. 99. A steel try-square is used in connection with the ring groove go-gage, and checks it with the skirt of the piston.

Piston rings are also inspected very carefully. The fluid gage, Fig. 100, tests the ring thickness within close

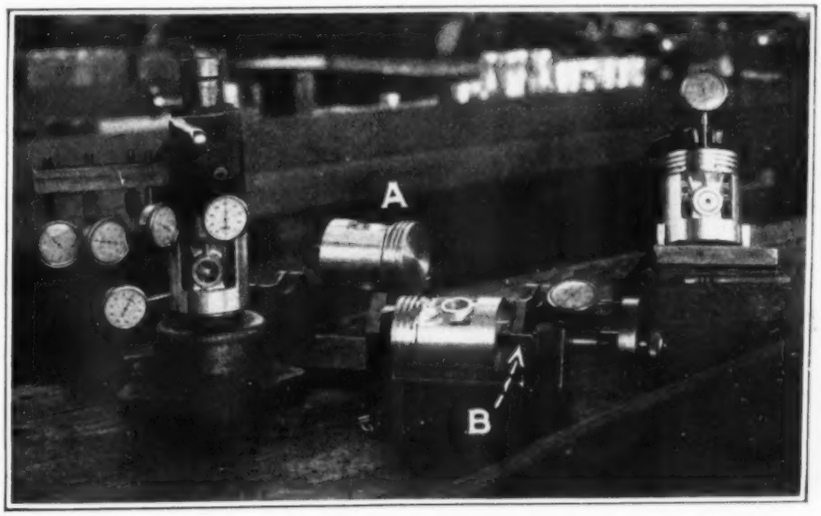
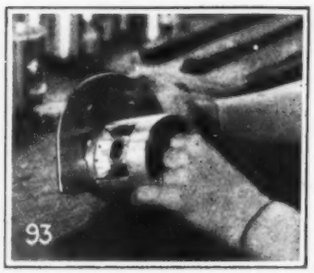


Fig. 92—Four gages that check concentricity, diameter, ring-groove width, head thickness and distance from piston pin to top of head. These gages are convenient to use with the dial indicators shown

Conclusion of the seventh article. The eighth will appear in an early issue.



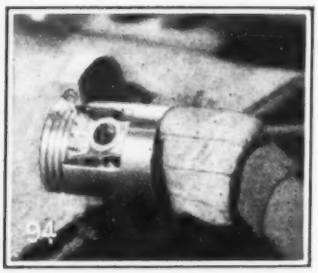


Fig. 93—Snap gage for checking the diameter of piston on the lands between the ring grooves. This gage is of the go-and-no-go type and is light enough to be handled with ease. Fig. 94—A similar gage for checking the diameter and width of ring grooves. The gaging point is removable and is adjustable for wear. The use of gloves makes the work easier on the inspector's hands

limits. The spring strength of the ring is weighed on the scale shown in Fig. 101, where the gap is closed by the device mounted behind it. The ring rests on the scale platform, and the pressure required to close the ring to the diameter of the cylinder is read easily on the scale.

The gap in a piston ring is quite important, but it is not an easy thing to measure. In the Hupp plant the light method is employed, and the inspectors become very expert in knowing when the gap is just right. The rings are forced by the lever at the right through the chamber that represents the cylinder, Fig. 102, the gaps being exposed by an opening in the upper part of the chamber. An electric lamp placed inside the rings throws light through the gaps and makes it easy to inspect them rapidly.

A similar device, Fig. 103, from the Graham-Paige plant, shows how the rings are put into the gap-checking device. They are slipped into a recess just ahead of the plunger, and turned until the gaps snap over the thin guide strip at the top. This locates all the gaps in the same position. The lever at the right forces the rings into the chamber where the gaps can be seen through the opening in the top. The light from an electric lamp in the chamber passes through the gaps. The ring pressure is weighed on the scale in Fig. 104. For convenience and rapid handling, the rings to be tested are arranged on arms as at *A*, the arms having weighted bases so as to hold them in a convenient position for the operator. The girl picks a ring from the rod, places it in position and pulls the lever *B* down by a treadle, closing the ring. The chart on the scale is made especially for the rings. A clever arrangement of mirrors makes it easy for the operator to read the chart on the scale without looking up. Mirror *C* at the top reflects the image of the pointer and its reading to the lower mirror *D*, which is in front of the eyes of the inspector. This arrangement of mirrors enables her to read the pressure at the instant the ring closes, without changing her position or shifting her eyes. The tested rings are placed over the wooden post at the left.

The Continental method of testing the closing pressure of the rings is very simple, as shown in Fig. 105. A standard spring scale has a fixture mounted on the platform, while the upright behind the scale carries a lever and a plunger that enable the pressure to be applied at will. The ring rests on a steel plug and is supported at the side by a stop that is adjustable in one of the 45-deg. slots so as to locate the ring sidewise. A graduated scale behind the pointer *A* shows when the ring has been closed to its proper diameter. The pressure required to close the ring to this point is read directly on the scale dial.

The Franklin method of inspecting piston rings is shown rather completely in Fig. 106. Beginning at the left, *A* is a surface plate carrying two parallel bars that form go and no-go gages for the thickness of the rings. This type of gage is fairly common and deservedly popular, as it is an easy matter to slide the rings under the go gage and then to see if they pass the second bar. At *B* is the convenient form of go and no-go gage for testing the thickness of the rings. The gage is mounted in a convenient handle, and a little practice makes it possible to test the width at various points at a rapid rate.

Behind this, at *C*, is a device made in the Franklin shop to test the roundness of the piston rings after they have been closed-in to their running position. At the upper end of the cylinder shown is a collar with a narrow face that represents the cylinder bore. Suitable supporting points hold the ring level inside the collar. In the cylinder below is an incandescent lamp, and the light from this makes it very easy to test any out-of-roundness by the light showing between the ring and the gage. The strong light from below is intercepted by a diaphragm and can escape only around the outer edge of the ring, making it easy to detect even slight irregularities. The effect of heat is offset by an air jet when in

Fig. 95—Three gaging operations on the head ends of pistons in the Chrysler plant. The gage in front checks the squareness of the piston pin hole and also the distance from the hole to the top of the head

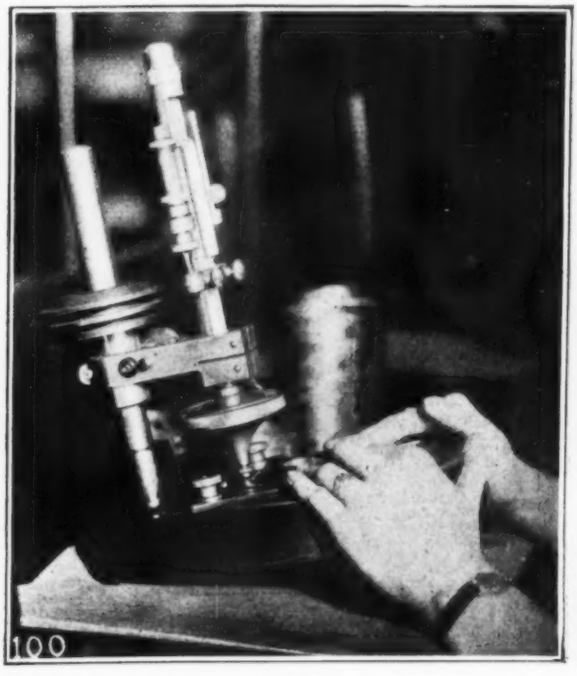
Fig. 96—Piston ring inspection in the same plant. The width of rings is checked by go-and-no-go gages made up of hardened disks separated by suitable spacers. Waviness of rings is checked by dial gage at right

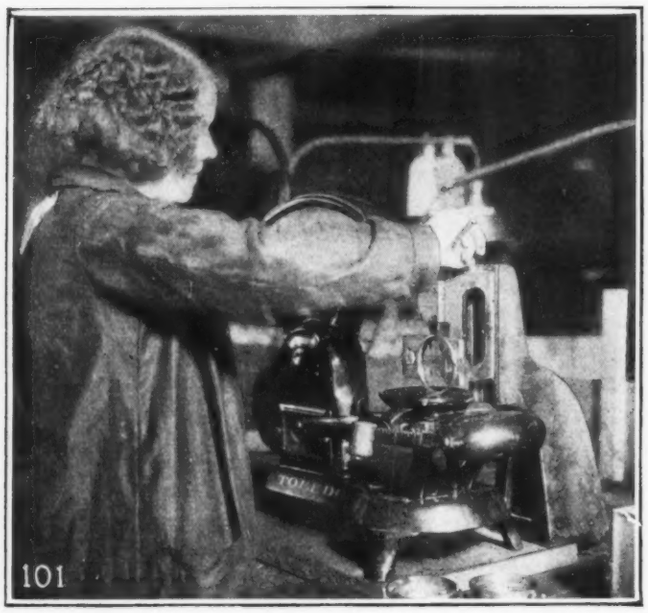
Fig. 97 — Checking the roundness of piston rings by inserting them in a recess having a lamp beneath it. This test shows light around the outside of the ring unless it is round

Fig. 98 — Measuring the thickness of the piston head. The projection on the spring-controlled plunger carries a rod that contacts with the pointer on the dial gage

Fig. 99—Using a steel square to test the squareness of the ring grooves with the skirt of the piston. The go-gage for ring width shows any angularity with the blade

Fig. 100—Checking the thickness of the piston ring by a fluid gage. The rings are tested at different points to detect any deviation from parallelism





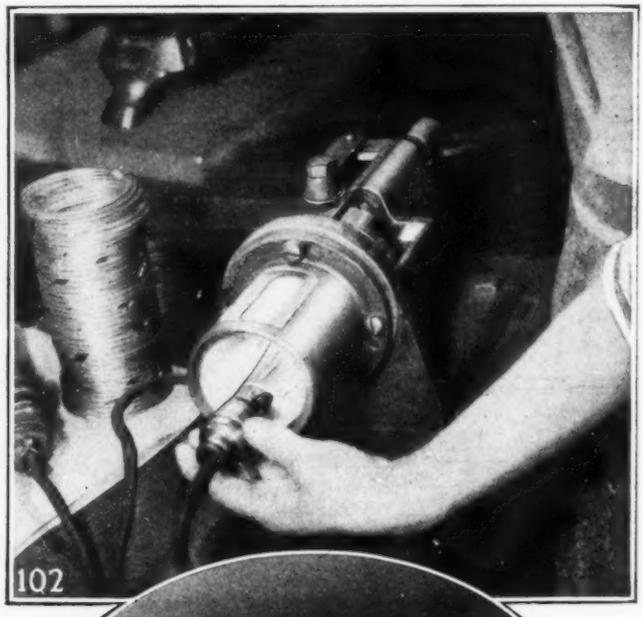


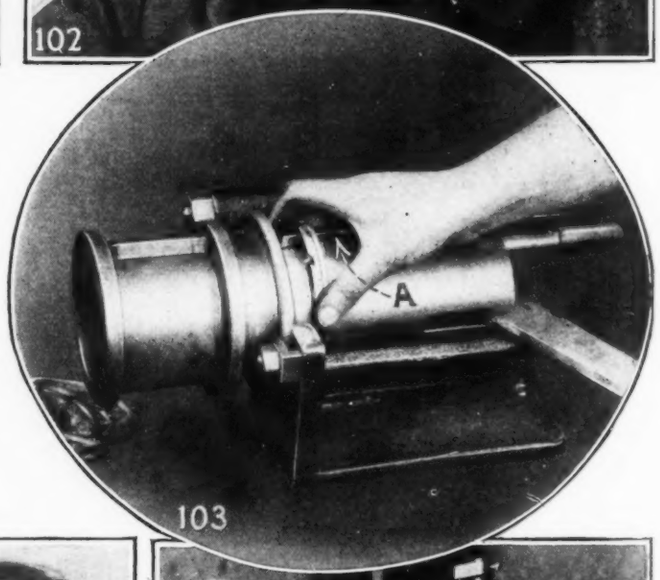
Fig. 101—Fixture for use in connection with a standard scale to show the wall pressure of piston rings. The small handle is operated to close the ring to cylinder diameter

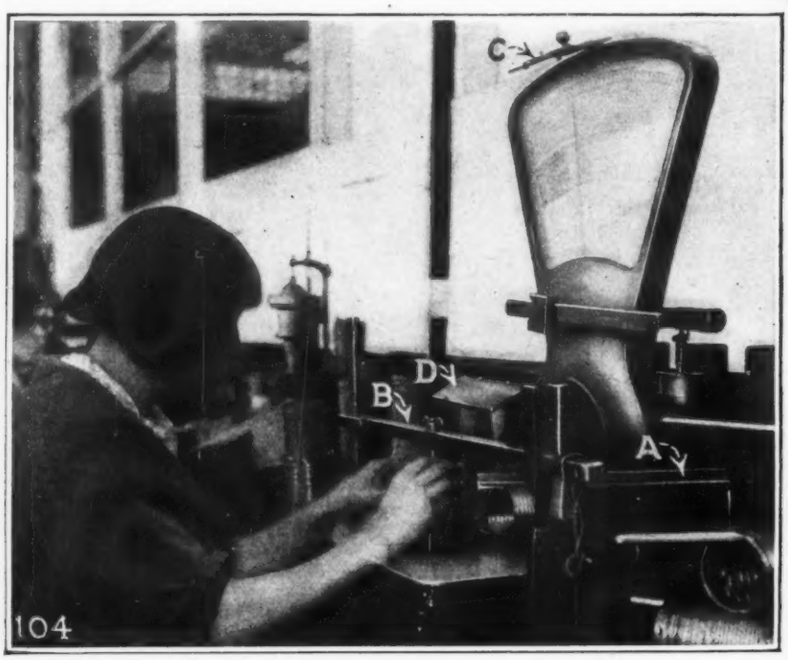
Fig. 102 — Checking piston ring gap. The rings are forced through a sleeve representing the cylinder bore

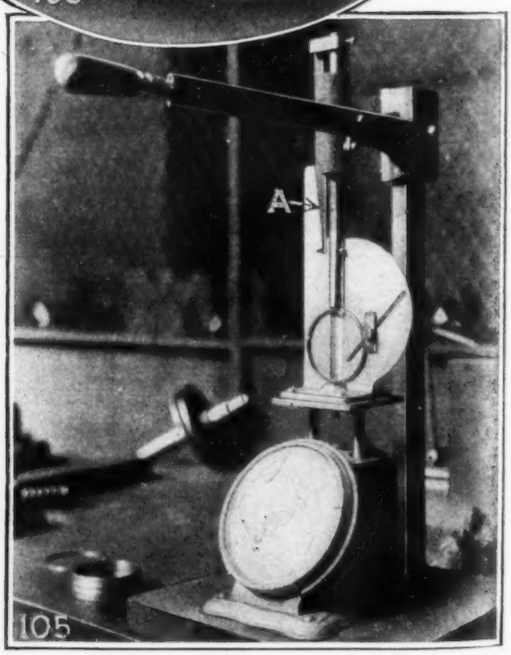
Fig. 103 — A similar device showing more details of its construction. The steel strip under the hand locates the position of the gap

Fig. 104—Weighing the pressure required to close piston rings in the Graham-Paige plant. The two mirrors are so arranged that the reading of the scale is reflected to the lower mirror, so that the operator does not need to move

Fig. 105—Another method of weighing the closing pressure of piston rings. The ring is held in a frame on the platform of a standard scale







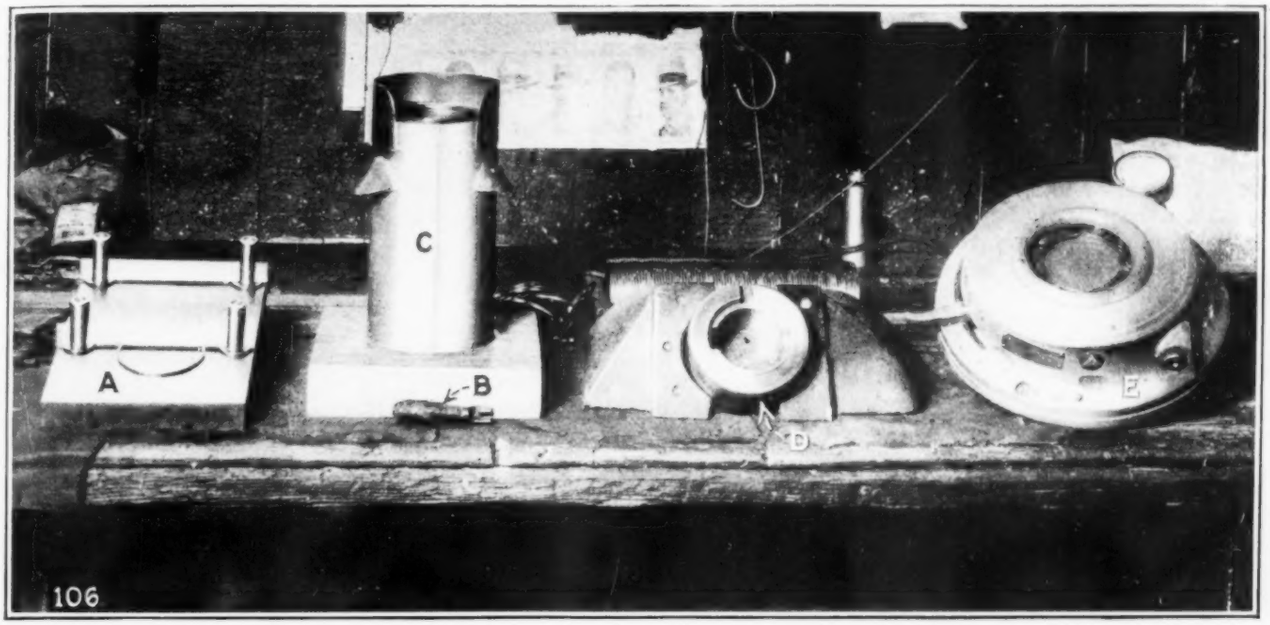


Fig. 106—Franklin gages for piston rings. Included are limit gages for thickness, a special device for testing concentricity by the light method, a standard ring for closing rings so as to check the gaps, and a combination gage that shows diameter and the closing pressure when the rings are closed

Fig. 107—Marmon device for checking the gaps of piston rings. The rings are placed on the large plunger at the right and are closed by forcing them through the cylinder at the left. An opening in the top of the cylinder wall shows the gaps in the closed rings

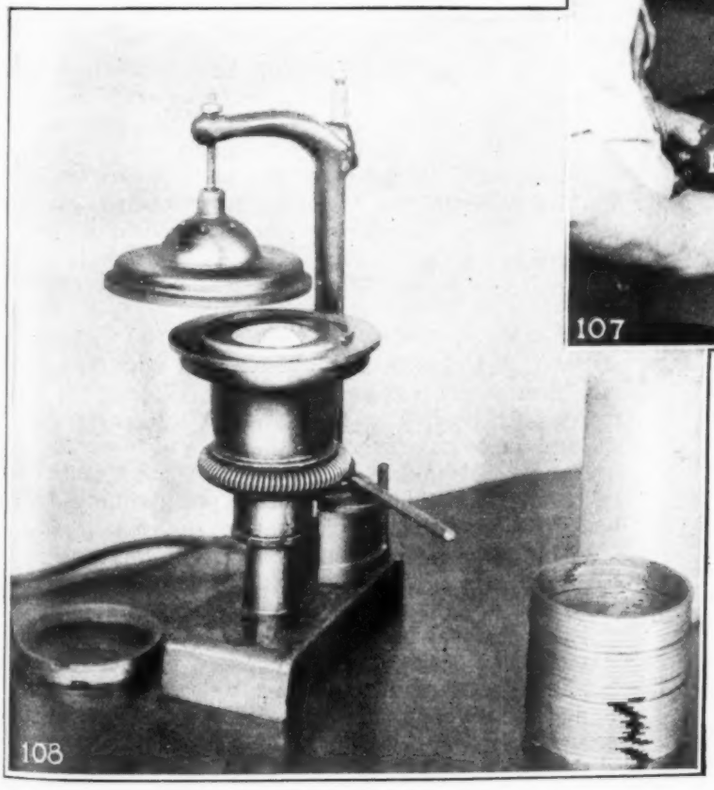


Fig. 108—Electric light device for detecting waviness in piston rings. With the cover lowered on top of the ring, light rays can escape only between the sides of the ring and the two plates, showing any irregularity that may exist

use. The air jet keeps the whole device at an even temperature, and so avoids any errors from temperature that might otherwise be introduced. Next in line is the gap checking fixture at *D*. Here again the ring is closed to its proper diameter with the gap at the top in the slot shown. The gap opening can thus be readily checked, either visually, or with a feeler as preferred. The device at the right, *E*, is made by the Pittsburgh Testing Laboratory for measuring the outside diameter of the piston ring and for indicating the pressure required to close it. The device is operated by the handle at the left, the various rollers on the inside being closed evenly around the ring and compressing it to the proper diameter. This method cannot, of course, show continuous concentricity, as in the light testing device *C*, but it does permit the gap opening to be measured and also shows the stiffness of the ring against closure.

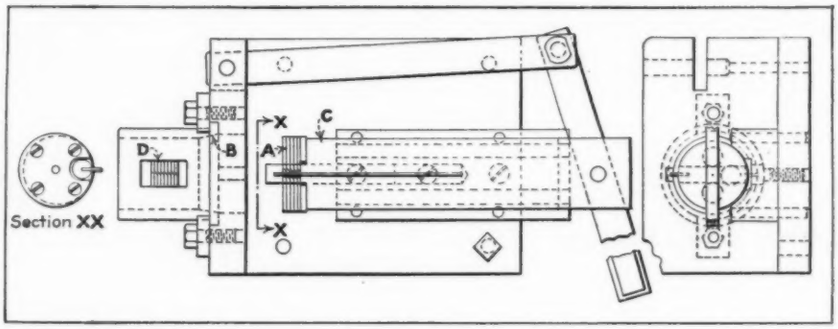


Fig. 109 — Details of the gap measuring device. It shows how the narrow strip in the top of the rod aligns the rings with the gaps uppermost, the enlarged chamber to receive the rings before closing, the closing taper and the opening for examining the gaps

Piston rings for the Marmon-8 are inspected for gap width on the device shown in Fig. 107. The base casting *A* carries a projection at *B* and a V-block *C*, in which the bar *D* rests and moves. On the upper side of *D* is a strip of steel *E*, $\frac{3}{32}$ in. thick and projecting above the bar as shown. This strip is let into a slot in a $\frac{1}{4}$-in. round rod that is a sliding fit in the large bar *D*. With this small rod pulled out of the end of the bar, piston rings are slipped on it. The strip separates the gaps so that the rings hang on it. Movement of the lever at the right forces the bar so that the rings enter the upright portion of the base. Continued pressure brings the end of the small rod against a stop, and the bar *D* then forces the rings off of the rod through a tapered chamber and into the bore of *B*, which represents the bore of the engine cylinder. Projection B has an opening at the top, through which the inspector can readily determine by measurement or visual inspection, whether or not the gaps are of correct width.

Fig. 110 — The Pierce-Arrow method of insuring flat rings. Each ring is inspected carefully and then straightened, if necessary, on the flat plate at the top of the stand. The anvil at the side is used in peening rings to take out kinks that affect roundness. The several curvatures are to accommodate rings of different diameters

As the action cannot be clearly shown in a photograph of the device in use, a partial detail is given in Fig. 109. The rings are shown with the gaps open at *A;* also the tapered bore *B*, by which the rings are closed after being forced off of the rod by the large bar *C;* and the opening *D* through which the gap can be seen.

Another testing device using a lamp in the interior is shown in Fig. 108. This device, however, is not for testing the roundness of the ring, but for detecting a lack of parallelism between the two sides commonly known as "wave." The ring is placed on the table surrounding the lamp bulb, and the upper piece, or cover, is placed over it. When viewed from the side, any "wave" will permit light to come through and is easily detected. This method is used by the Yellow Sleeve-Valve Company.

In some shops, considerable attention is paid to the width of gap left when the ring is closed to its proper diameter. The gap is usually tested with a feeler, which is applied while the ring is compressed in a gage that represents the cylinder. In the Nash plant the rings are checked for width of gap after they have been assembled.

The piston is pushed into a sleeve that represents the cylinder. An opening in the sleeve permits the gaps to be tested with a feeler while the rings are closed.

In order to secure proper fitting, the Pierce-Arrow Company pays particular attention to the flatness of the rings and finds it advantageous to take out any slight waviness that may be detected. This is done as shown in Fig. 110, on a flat, iron plate raised to a convenient height. The stand also carries a specially shaped anvil having two different curvatures, below the plate used for straightening. It is used in peening the rings to take out slight kinks.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Making Foremen—or Importing Them

"I DON'T see why Williams is fussing along with Jack Kilner over in the toolroom, Al. Jack is a nice chap, all right, but he'll never make a real foreman. Why don't he go get a man from an outside shop and be done with it? That toolroom needs stirring up a bit, anyhow."

"Williams is trying to play square with the men in the plant, Ed. He knows as well as you do, that it would be easier to get a man from the outside. But he also knows how discouraging that would be to every man in the shop. If he can nurse Jack along and make a foreman of him, it ought to chirk up every young fellow in the plant who wants to get on."

"But I thought he liked to get new ideas from the outside, Al?"

"He does, Ed. And there are several reasons why he'd like to go outside for a new foreman. It would be easeir for him; we'd get some new notions as to tools; we might get a better tool system, and we might wake up some of the foremen to seeing the necessity of training an understudy. That's what ails the toolroom now.

"Old Bill Irving never gave any of his men a chance to get acquainted with his job. So when he gets in the way of that automobile and passes out, Williams is up against it."

"Seems to me that's reason enough for going outside for a new foreman, Al."

"It is, Ed, if Williams wasn't such a square shooter. But he expects loyalty in his men, and he believes it works both ways. Jack Kilner was the oldest man in the toolroom in point of service, and Williams felt that he had possibilities—so he's doing his best to coach him along and make a foreman of him. He wants to encourage the men to work for the better jobs. And it wouldn't be very encouraging to any young man to put an outsider in the formanship without making a try at using one of our own men."

"Then how are we going to get new ideas into the shop, Al?"

"That's another of Williams' problems, Ed. But it's a different story. He could get new ideas by firing a lot of us foremen—and he might save money temporarily. But you know how it would demoralize the shop. And sooner or later that counts on the cost of getting out work. If you cut out the incentive of possible foremanship, the very men you need most will hunt other jobs.

"I'm hoping he'll make a real foreman out of Jack Kilner. It will help shop morale a lot."

Is Al right in defending Williams? Or should he get new foremen from the outside occasionally? How much would it discourage the young man in the shop?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Equipment and the Foreman's Reputation

ED IS right. The foreman should not quit, but should run whatever machine the boss provides. However, the management should have brought forcibly to its attention the evil effects due to the use of equipment that is not modern. Costs will be greater and production will be lowered if the use of poor equipment is insisted upon and continued.

The foreman's reputation need not suffer if he presents his plea for better equipment to the management. Bringing this matter forcibly to the attention of the boss may make him see the light, and take the step in the right direction.

The object of equipment and machinery is, of course, to produce goods. Any machine, tool, or appliance, which does not contribute to the economy of the work is useless equipment; and it is the job of the foreman to see that such equipment is disposed of, and useful equipment used. —A. GORDAN.

IF A particular machine is old and not turning out the work that the boss expects it to, it is up to the foreman to convince the boss that he is losing money by not having a new machine. If the machine is in a repairable condition, the foreman should advise the boss that the machine can be made as good as ever.

The boss has so much to think about, especially in keeping up production, that he cannot always give his attention to each individual machine in the shop. It is, therefore, up to the operators and the maintenance man to notify him of the condition of such machine.
—A. MELDRUM.

BILL'S case is one where action should be governed by sound judgment, considering the merits of the case. If his employers were really endeavoring to ride out a storm, or to evade receivership during a period of depression or readjustment, it is up to him to resort to every resource within his power to make the equipment at hand produce the required output. He should spare neither himself nor others, in his endeavors to get results. —H. G. DOWNS.

Paying More to Save Money

IT IS the foreman's duty to interfere in the design of the product which he is manufacturing, and he should in every case report on the high cost of tooling irrespective of whether it is caused by material or intricate design. The specification or kind of material that goes into a product in some cases is chosen by the customer, and in many cases it gets past the engineering office and into the shop before the question of manufacturing costs is considered. Right here the foreman has a tough job in getting any change across, and more often than not the usual answer is "customer's requirements." The narrative plainly proves the necessity of the foreman raising his voice to help his firm produce better work at lower cost, and by doing so he will bring the engineers out of the office into the shop, thus developing mutual cooperation. —C. L. HENRY.

THE · NEXT · TOPIC

The Boss's Son in the Shop

ADVANCE QUESTION

The big boss of the plant puts his son in the shop with instructions that he is to receive no favors but to work like anyone else. Al says it can't be done, that he is sure to get different treatment than anyone else. Is he?

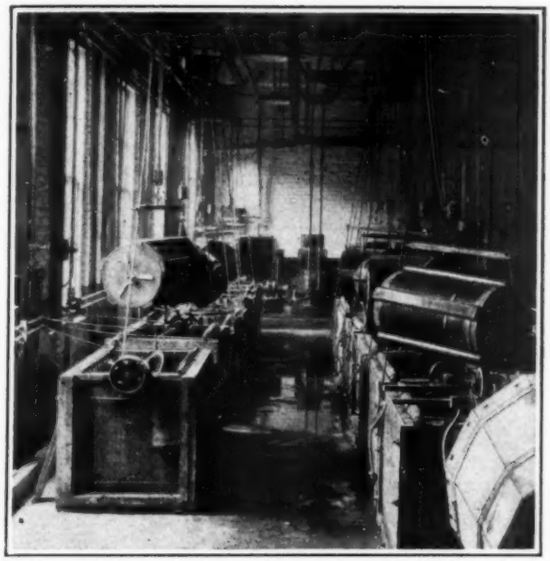
Wear Goggles or Quit

EYE shields, when properly installed on grinding wheels, possess all the convenience of goggles, and equal or perhaps greater assurance of safety. The use of poorly made goggles is probably worse than no protection at all, because of the danger of broken glass, and goggles provided with glasses which are off color are likely to weaken the eyes of the wearer. Also, the glasses become pitted on the outside from the abrasive action of the flying particles. Hence, the glasses should be changed often. The goggles should be as light as possible, and should have side protectors. The metal parts should be rustproof, and easily adjustable to conform to the shape of the face. —E. ANDREWS, *England.*

Standards for Machine Finishes

THERE are many cases where the actual finish required needs a special note on the drawing. A range of samples exhibited in each department, each sample being given a reference letter or number, will soon get the workman used to the various finishes required. It is then only necessary to quote the reference on the drawing. Most men in the shop will be only too pleased to know how best to produce the required standard of finish.

Many firms when sending out parts to be made specify "dimensions to drawing, finish to sample." This practice saves much argument.—A. F. GUYLER, *England.*



Plating and Finishing *on Contract*

By George S. Brady
Associate Editor, American Machinist

CONTRACT plating as a specialized business is relatively new, and, unlike contract machine-shop work, there are comparatively few factories doing finishing operations on parts and articles for others and manufacturing no product themselves. However, the importance of the contract plating shop in any manufacturing center is apparent. It gives the small production manufacturing plant a medium for obtaining highly specialized work on an operation that might not warrant the expense of a separate plating department and trained staff, and it also is in a position to take care of overflow and special jobs from the larger manufacturing plants.

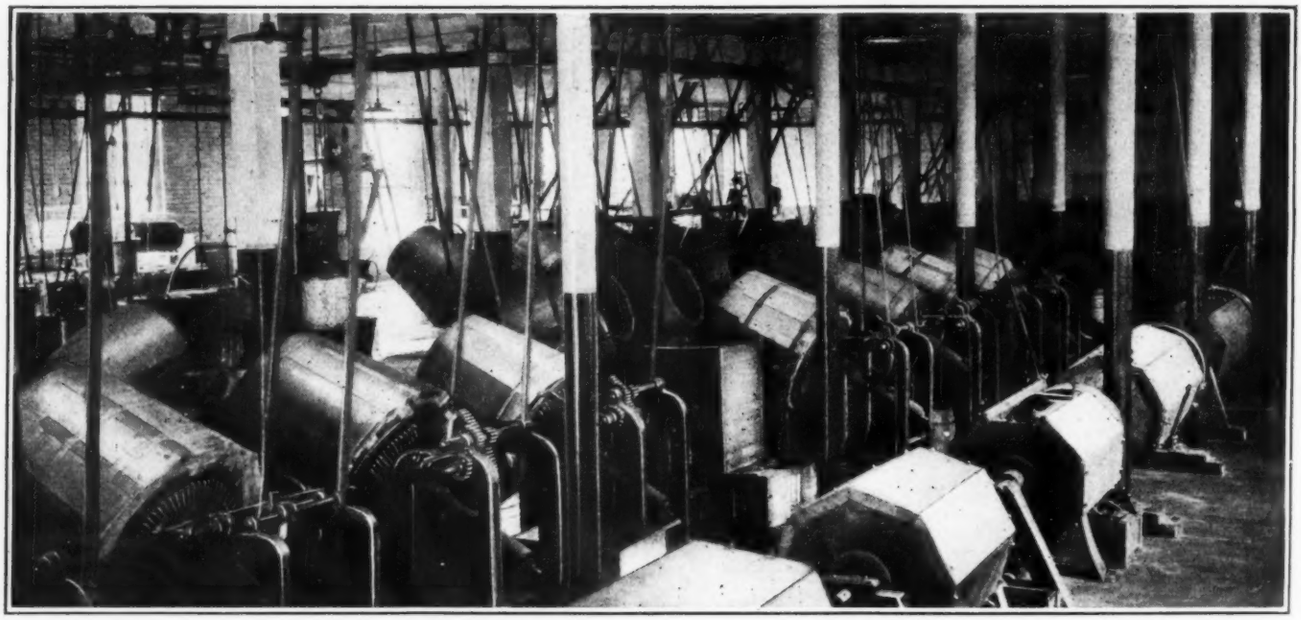
At the plant of the Contract Plating Company, Bridgeport, Conn., which is typical of the successful contract plating shop, practically all work is put on a production basis. This is possible because of the relative simplicity and similarity of operations to be performed on all work as compared with the operations required for contract machine work. The plant has an average production of 14,000 pounds of work daily, made up mostly of hardware, novelties, toys, and electrical instrument parts.

All production work is taken in on a contract weight basis, originally figured, however, on a basis of the operations to be performed on the part. Large parts which usually come in singly or in small lots are done on an hourly basis either by advanced bid or on an actual time charge. In making bids for regular plating work from a manufacturing plant, the contract shop endeavors to meet the part cost requirement of the customer. In other words, the contract plating shop makes it plain that it is willing to help the production manufacturer produce his product in a competitive field. In a sense, therefore, the contract plating shop of this type is operating as the co-operative plating department of its several customers who are making non-competing products.

The more "steady" customers that the shop can contract with in this way, the better position it is in to place itself on an efficient production basis. In the case of the Contract Plating Company, one customer supplies about 2,000 lb. of parts for plating per day. Another 1,500 lb. comes from radio makers, and the balance is obtained from a miscellaneous group of toy, novelty, hardware and automobile accessory manufacturers. It will be noted that this work is more or less of a similar nature, both as regards size and the nature of operations to be performed. It is recognized that it is not economic for the contract shop to vary its work over too wide a field. Having once established a line of regular customers the contract shop has by no means ended its sales and advertising problem. It has been found necessary for the shop manager to keep in close contact with the requirements in the field so as to be in a position to fill any gaps with new jobs or to meet any excess production requirements of his customers. The extra equipment capacity is thus kept below 25 per cent.

The shop is arranged for progressive production. Practically all ordinary commercial plating is included under nickel, cadmium, brass, copper, and zinc, and permanent groups of baths are kept for these plates. Chromium, which has been called the modern sensation in plating, has not yet found extensive use in small parts

The plating tanks are arranged in groups according to the class of plate. Each group has an independent dynamo and separate washing tanks. Extra-heavy copper lead bars are used so that, in case of shutdown of one dynamo, the current can be switched over without heavy line loss



Fifty tumbling barrels of various types are provided, and practically all quantity work on small parts is buffed and polished by tumbling. Wooden barrels are preferred to those of hard metals so as to prevent marring of the parts. The time of tumbling varies from about 2 hours to a week, the latter being required for rough castings

manufacture, but the increasing demand for this covering for tools, gages, and automotive parts for its wear-resisting and corrosion-resisting qualities is making it advisable for the contract shop to count chromium as one of its regular lines. Work requiring bright dipping, oxidizing, gold and silver plating, "copper dip," or special finishes is taken in as an accommodation to regular customers, or in cases where the quantity warrants.

The main floor of the shop contains the equipment for regular production. In the basement are located the tanks and other equipment for the heavier and special jobs, although this can serve also for overflow work. Parts arriving from customers are received from the trucks onto a platform which is on a level with the main shop floor. The outgoing work is delivered to trucks from a similar platform at the other end of the shop. The regular express trucking services now established between the industrial cities in the east makes it possible to have rapid collection and delivery service between the contract shop and customers within a radius of about 100 miles.

Tumbling Methods

The shop is equipped with 50 tumbling barrels of various types, all grouped together at the receiving end of the shop. At the side of these is a heavy polishing room having 6 double-wheel machines. The modern tendency is to do all polishing possible in barrels rather than separately on wheels. Improved methods of tumbling is making this possible on almost all kinds of small parts. Most of the barrels are of the tilting type for easy dumping of the work, but those used for ball-rolling are of the horizontal type. The shop has four solid brass barrels, and the preference is for brass or wooden barrels although they wear out more rapidly than the steel ones. The polish given by the ball-rolling barrels on novelties and hardware parts is claimed to be almost as good as that obtained by hand buffing, and to be entirely satisfactory for these articles. Parts having screw threads can be handled by this method without spoiling the threads. The time of rolling varies from a few hours up to a week, which is the time required for rough castings.

From the rolling and polishing departments the work goes across the room to the plating tanks. The production plating is handled entirely by the barrel method. The tanks are grouped according to the class of finish for simplicity in handling the chemicals. Each group has its own cleaning equipment consisting of soda tank, acid rinse, hot and cold rinsing tanks, and a hot soap-water tank for neutralizing the acids left on the work after plating, and for accelerating the drying. The groups consist of 22 nickel-plating tanks, 5 cadmium tanks, 5 zinc, 3 brass, and 2 copper-plating tanks. All of these are of the revolving barrel type. The still tanks, 9 in number, are located in the basement, and are used for the special plating and large parts.

All tank groups are equipped with overhead trolley systems so that the work is handled easily from the polishing departments, from one dipping tank to another, and to the plating tanks. The plating current is supplied by 3 dynamo units having a total capacity of 7,500 amperes. The voltage varies from 6 to 12 volts, depending on the class of plating being done. There are 2-in. copper leads from each machine in order to reduce line losses to a minimum. The leads are arranged so that each dynamo group is operated separately, or the load can be shifted from one to another in case of the breakdown of one.

From the hot rinsing tanks the plated work is carried on the trolley to the end of the room, where it is dried either in a centrifugal drier in a blast of air, or in hot sawdust. The latter method is very effective, but cannot be used for parts having small holes or eyelets where the sawdust is apt to stick. The shop is also equipped with a steam drying oven for handling large parts. After drying, the parts pass directly into the shipping room for inspection and delivery. The ideal condition aimed at is to have the parts pass continuously from receiving platform to shipping platform with no storage. This can usually be done, and the shop is therefore able to

work with only a small storage space in the shipping department.

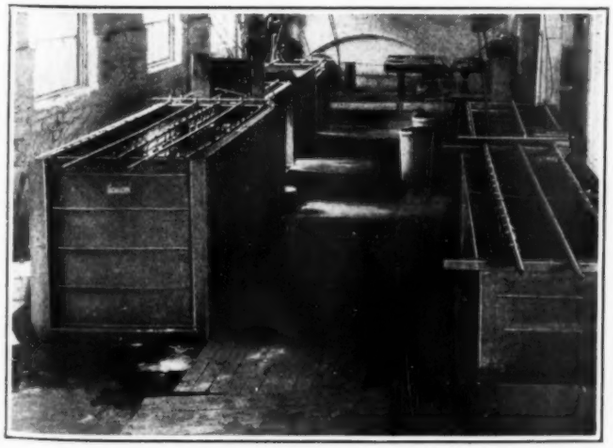
Parts that are to be lacquered go to a separate room protected from dust. Some of the lacquering is done in a rotating barrel which tumbles the pieces while a jet of lacquer is played on them from an ordinary spray gun.

The inspection is visual throughout, and the final inspection is done by the shipping clerk who is especially trained for the work. Each plater is capable of checking up his own solutions, and the foremen of the plating and polishing departments are responsible for the quality of work. The manager of the shop acts as a general foreman because of the recognition that the small shop cannot stand a heavy overhead. Every lot of work entering the shop is looked over by the manager who designates on the work tag the quality of finish and time of run. The shop has a completely equipped chemical laboratory where samples can be taken for wear and corrosion testing, or where the plating solutions can be tested.

All ordinary mechanical maintenance is handled by one mechanic who is on the job continuously. This work includes replacement of wooden sides in tumbling barrels, and of the worn sides of plating barrels. The perforations in the celluloid sheets for plating barrels are drilled in quantity, and the sheets put on as required for replacement. The setting up and gluing of polishing wheels is done by the polishers themselves.

Handling Personnel

The handling of personnel by the Contract Plating Company follows the general lines of the modern progressive small shop. There are 30 employees, practically all of whom are skilled men. With a shop of this size it is the idea of the manager that he can keep in close contact with all of the employees, working, of course, through the foremen. The policy is to develop self-reliant workmen who can be trusted to handle efficiently the varying work, and to carry along the program during the absence of the manager. There is no piece-work, or any form of bonus payment. There is also no overtime paid, and no "docking" for lateness or occasional absences. It is felt by the manager that the small shop with a selected force has no need for firm rules covering these points. The success of the method is shown in the fact that there have been no changes in personnel in the shop in more than 3 years. The laboratory at the present time is operated by the manager, who is a chemist and specialist in plating, but ordinary solution tests and standard corrosion tests can be cared for by the platers themselves. The office is handled by one clerk. This is possible because of the fact that the routing of work is done entirely in the shop on tags made out in the receiving room, and the shipping memorandum and invoice are the only papers required in the transaction. Moreover, the cost accounting is simplified by the straight hourly basis for the workmen, and the flat rates quoted to customers.



Still tanks are used for plating small lots or large pieces. They are also used for special plating requirements that would interfere with the regular production plating in the barrel tanks. Extra-deep still tanks are provided for handling very large work

Cleaning Up at Special Times

By Joseph Viggiano

IN A large machine shop it was the duty of one of the laborers to make regular rounds of the machines during the day to remove the turnings and chips. This was being done during the regular hours, and the shop manager noticed that frequently the machines were stopped by the operators while the sweeper was clearing away the turnings. He observed also that there was a tendency for the men at the machines to "fool" with the one who was removing the turnings.

After noting conditions, the manager hit upon a scheme of having this cleaning and sweeping-up of turnings made during the noon hour when the machines were idle. The work could be done then without loss of time on the part of the operators and machines. The absence of risk of injury from contact with the moving machines and hot chips was another advantage. The same operation was repeated after working hours at night, so that the machines would be clean for the resumption of operations in the morning.

Efficiency of Respirators for Protection Against Paint Sprays

SURGEON-GENERAL H. S. Cumming, of the U. S. Public Health Service, has recently announced (Public Health Bulletin No. 177) the results of an investigation undertaken at the request of a committee appointed by the National Safety Council. This investigation was made to determine the value of respirators as a means of protection from the hazard of spray painting resulting from exposure to lead, benzol, and silica.

It may be stated, as a result of the tests, that in general the respirators with cotton, paper, or fabric filters remove 90 per cent or more of the lead from air carrying paint mist. These respirators restrain none of the solvent vapors, however, but the addition of a canister or cartridge of activated charcoal to the respirator removes all solvent vapors until the charcoal becomes saturated. The useful life of filters is determined by their increase in resistance, which necessitates changing for fresh filters at intervals of several hours. When charcoal is saturated, the cartridge must be exchanged for a fresh one. Canisters of the size used with gas masks may last for weeks before a change is necessary.

The respirators were found to be somewhat less efficient against the silica dust sprays, but they restrained 24 per cent or more of the dust from the air passed through them.

· TECHNICAL · ABSTRACTS ·

Skid Shipment of Materials

A skid platform consists essentially of a flat platform supported above the floor on runners or corner posts. At the present time about 9,000,000 are in use. They are moved by hand or electric lift trucks. About 90,000 hand trucks and 8,000 electric lift trucks are now in service. Electric lift trucks are fairly well standardized as to the major dimensions of height and width of lifting platform.

Direct cost of material handling is estimated at $3,500,000,000 per year, of which $700,000,000 is estimated as the cost of handling, loading and unloading goods which can be shipped on skids. No comprehensive survey has ever been made of the cost of these operations. Figures secured from shippers show direct savings from 25 to 90 per cent in cost of packing, handling, loading and unloading, resulting from the use of skids for inter-plant shipment. Total possible savings are estimated at from $200,000,000 to $500,000,000 per year, but, in order to accomplish such savings, national standards of dimensions are essential.

The principal savings will accrue to shippers, but railroads will benefit through faster loading and unloading of cars and heavier car loadings in certain commodities. Manufacturing plants will benefit through easier maintenance of a steady flow of material. These benefits have been limited up to the present time by the lack of interchangeability of equipment. In the automotive field, plants require parts and supplies to be shipped to them on skids. The following is now a national standard: The clearance height from bottom of runners or other supports to underside of platform should be either 8 or 12 in., and the minimum horizontal distance between inside of runners and other supports should be 27 inches.—*Manufacturers' Record*, Sept. 13.

Navy Method of Selecting Oils

In order to hold to the standard set and to treat all suppliers impartially, solely on the merits of the goods they furnish, the Navy Bureau of Engineering has worked out methods of specifying and testing which will undoubtedly be of considerable use to manufacturing plants. The idea is to place purchasing on a practical work factor basis, which will be explained. Through establishing certain minimum requirements, it is possible frequently to make up a list of oils such that—assuming the selection of the proper viscosity—any oil on the list will meet a specific requirement. These "good" oils, however, will vary somewhat as to the length of time during which they will maintain the initially good service. To determine the work value for mineral lubricating oils, the best method is to consider only the chemical and physical properties affected by use, and to grade the oils on the changes taking place during use.

The following machine is suited for such testing for simulating actual conditions. A journal of steel, 3⅞ in. in diameter, and 6 in. long, revolving in a babbitted bearing and driven by a variable-speed motor is calibrated for foot-pounds lost work at different speeds. Force-feed lubrication is used. The lubricating oil is circulated from the reservoir to the top of the outside of the bearing by means of a motor-driven rotary pump. A pressure of 150 lb. per sq.in. is uniformly applied to the test journal by means of four calibrated springs, each provided with a scale. The temperature of the bearing is obtained from reading two mercury-glass thermometers, set in the upper part of the bearing. The lubricating oil is allowed to attain any temperature which it will. The test continues for 100 hours at the rate of 8 hours per day, starting cold each day. At its conclusion, a comparison of the physical and chemical properties of the oil with those obtained before the test began is made.

The factors which change during use under the conditions of the endurance test are viscosity, organic acidity as acid number, matter insoluble in 88 deg. Baumé gasoline, and the carbon residue. The present knowledge of the subject of fluidity does not warrant its inclusion. Viscosity is determined at three temperatures, 100, 130 and 210 deg. F. An increase in viscosity up to 20 per cent at one or all of the three temperatures is considered to be acceptable. The following formula is used to compute the work value of increase in viscosity at each temperature, three work values entering into the final work factor:

$$\text{Work value} = \frac{1.00\left[\frac{FV - IV}{IV}\right]}{0.20}$$

where FV = Final viscosity
IV = Initial viscosity

Organic acidity, matter insoluble in 88 deg. Baumé gasoline, and carbon residue will all increase in content to some extent during the endurance test, the poorer oils showing the greater increases. Inasmuch as any content beyond that allowable is considered sufficient reason for rejection of an oil, two ratings will be given to each of these factors, one based on the initial content, and other on the increase in content during the endurance test. Two formulas as follows will be used.

1. $\frac{IR - IC}{IR}$ = Work value No. 1

2. $\frac{FR - FC}{FR - IC}$ = Work value No. 2

where IR = Initial rejection point
IC = Initial content
FR = Final rejection point
FC = Final content

Collecting the work values for the different factors, and striking an average, we have a "work factor" for the oil. To determine service cost of the oil, the bid price is divided by the work factor.—*Manufacturing Industries*, August.

Heat-Treatment of Duralumin

Duralumin contains 94 per cent aluminum, and the balance is made up of copper, manganese, magnesium, silicon, and iron, the last-mentioned element being present as an impurity. Duralumin in the "as cast" condition has properties like those of the ordinary cast binary alloys of aluminum. However, when mechanically worked into shape and suitably heat-treated, the ductility and tensile strength are increased to such an extent that the properties compare favorably with those of steel for certain structural uses.

Duralumin has a maximum tensile strength of 32,000 lb. per sq.in., after simple working such as forging, rolling, or extruding, followed by a simple cooling from 380 deg. C. The ductility is then 30 per cent, as compared with 3 per cent in the "as cast" condition. In order to secure higher properties, it is necessary to resort to a process of heat-treating. This heat-treatment consists of raising the metal to a temperature of at least 480 deg. C., (896 deg. F.), and then quenching. Properties brought about by this process are raised so that the tensile strength lies between 50,000 to 54,000 lb. per sq.in. after aging from four to five days. The elongation in 2 in. is 25 per cent. It is not desirable to raise the heat-treating temperature above 480 deg. C. as the alloy commences to melt at 550 deg. C., and the difference between these two temperatures is not sufficient to insure against blistering or partial melting due to lack of uniformity of the furnace temperatures which prevail when the process is carried out under commercial conditions. Immediately after quenching, the maximum stress is 33,000 lb. per sq.in. After being fully aged, the Brinell hardness number lies between 98 and 115, the measurement being made with a 6,600-lb. load and a 0.4-in. ball. The fatigue range of the material in the fully heat-treated condition may be taken to be plus or minus 19,000 lb. per square inch.

It is desirable to rough machine large parts to approximate size before heat-treating in an effort to obtain as nearly uniform hardness throughout the mass as possible. This practice tends to reduce warpage and dimensional changes, which are brought about by the various differential rates of aging, obtaining throughout the mass, causing differential volume changes.—Leslie Aitchison, *Fuels and Furnaces*, September.

Torsional Deflection Table for Shafting

Continued from sheet 22

The values in this chart were obtained from the formula given in Marks' Handbook, $D = 77.66 \sqrt[4]{\frac{hp.L}{N\ \alpha\ G}}$ from which $\alpha = \frac{3\ hp.\ L}{D^4N}$, where α is in degrees, and L is in inches; or $\alpha = \frac{2{,}200\ hp.\ L}{D^4N}$, where α is in minutes and L is in feet. In each of these formulas D = diameter of shaft, inches; G = modulus of elasticity in torsion (approximately 12,000,000 for all steels); N = r.p.m.; $hp.$ = horsepower; L = length of shaft; and α = the torsional deflection.

Where strength is the important factor, the shaft is short, and a small section is desired, a heat-treated alloy steel is desirable due to its high elastic limit. In some cases, vibration, variations in load or other conditions may make the use of alloy steel desirable due to its superior properties in impact and fatigue. However, in long drive shafts with low stresses, carbon steel may be equally satisfactory.

	Shaft Diam.	Revolutions per Minute																	
		1	2	3	5	7	10	15	20	30	50	75	100	150	200	300	500	800	1200
15 hp.	1¾	....	....	....	....	....	....	....	....	....	....	....	....	....	17.76	11.85	7.1	4.45	2.96
	2	....	....	....	....	....	....	....	....	....	....	....	....	13.43	10.6	6.85	4.13	2.58	1.74
	2¼	....	....	....	....	....	....	....	....	....	....	17.6	13.2	8.8	6.6	4.4	2.64	1.65	1.09
	2½	....	....	....	....	....	....	....	....	....	16.8	11.2	8.4	5.6	4.2	2.8	1.68	1.05	.70
	3	....	....	....	....	....	....	....	20.4	13.6	8.15	5.44	4.07	2.72	2.04	1.36	.81	.51	.34
	3½	....	....	....	....	....	....	14.85	11.12	7.43	4.45	2.97	2.22	1.48	1.11	.74	.44	.28	.19
	4	....	....	....	....	....	13.	8.65	6.5	4.32	2.6	1.73	1.3	.87	.65	.43	.26	.16	.11
	4½	....	....	....	16.1	11.5	8.04	5.35	4.02	2.68	1.61	1.07	.8	.53	.4	.27	.16	.1	.06
	5	52.8	26.4	17.6	10.57	7.55	5.28	3.52	2.64	1.76	1.06	.71	.53	.35	.26	.18	.11	.07	.04
	6	25.5	11.6	7.72	4.65	3.31	2.55	1.55	1.16	.77	.46	.35	.25	.15	.12	.08	.05	.03	.02
20 hp.	2	....	....	....	....	....	....	....	....	....	....	....	....	....	13.75	9.16	5.5	3.44	2.29
	2¼	....	....	....	....	....	....	....	....	....	....	....	17.6	11.72	8.8	5.86	3.52	2.2	1.47
	2½	....	....	....	....	....	....	....	....	....	22.62	15.1	11.3	7.55	5.65	3.76	2.26	1.41	.94
	3	....	....	....	....	....	....	....	....	18.12	10.88	7.25	5.43	3.62	2.72	1.81	1.09	.68	.45
	3½	....	....	....	....	....	....	....	14.78	9.84	5.9	3.94	2.95	1.97	1.48	.98	.59	.37	.25
	4	....	....	....	....	....	....	11.43	8.59	5.73	3.44	2.29	1.72	1.14	.86	.57	.34	.21	.14
	4½	....	....	....	21.43	15.32	10.72	7.15	5.37	3.58	2.14	1.43	1.07	.71	.54	.36	.21	.13	.09
	5	....	....	23.4	14.1	10.05	7.04	4.69	3.52	2.34	1.41	.94	.70	.47	.35	.23	.14	.09	.06
	6	34.	17.03	11.35	6.82	4.86	3.40	2.27	1.70	1.13	.68	.45	.34	.23	.17	.11	.07	.04	.03
	7	18.3	9.15	6.1	3.66	2.62	1.83	1.22	.91	.61	.37	.24	.18	.12	.09	.06	.04	.02	.02
30 hp.	2½	....	....	....	....	....	....	....	....	....	....	....	....	17.6	13.4	8.8	5.28	3.3	2.2
	2¾	....	....	....	....	....	....	....	....	....	....	22.5	16.9	11.28	8.45	5.64	3.38	2.12	1.41
	3	....	....	....	....	....	....	....	....	....	16.2	10.8	8.1	5.41	4.05	2.7	1.62	1.01	.68
	3½	....	....	....	....	....	....	....	....	15.58	9.35	6.23	4.45	3.12	2.34	1.56	.93	.58	.39
	4	....	....	....	....	....	....	....	13.	8.68	5.2	3.66	2.6	1.73	1.3	.87	.52	.32	.22
	4½	....	....	....	....	....	16.08	10.72	8.05	5.37	3.22	2.14	1.61	1.07	.8	.54	.32	.2	.13
	5	....	....	....	21.1	15.1	10.56	7.05	5.28	3.52	2.11	1.41	1.06	.7	.53	.35	.21	.13	.09
	6	....	....	16.98	10.17	7.27	5.09	3.4	2.54	1.7	1.02	.68	.51	.34	.25	.17	.1	.06	.04
	7	27.5	13.75	9.17	5.5	3.93	2.75	1.83	1.37	.92	.55	.37	.27	.18	.14	.09	.05	.03	.02
	8	16.1	8.05	5.37	3.22	2.3	1.61	1.07	.8	.54	.32	.21	.16	.11	.08	.05	.03	.02	.01
50 hp.	2½	....	....	....	....	....	....	....	....	....	....	....	....	18.8	14.1	9.4	5.65	3.52	2.35
	3	....	....	....	....	....	....	....	....	....	....	19.08	14.3	9.54	6.15	4.76	2.86	1.79	1.19
	3½	....	....	....	....	....	....	....	....	....	14.8	9.86	7.4	4.94	3.7	2.47	1.48	.92	.62
	4	....	....	....	....	....	....	....	....	14.4	8.66	5.78	4.33	2.89	2.17	1.44	.87	.54	.36
	4½	....	....	....	....	....	....	17.86	13.4	8.93	5.36	3.57	2.68	1.79	1.34	.89	.54	.33	.22
	5	....	....	....	....	25.2	17.6	11.73	8.8	5.87	3.52	2.34	1.76	1.17	.88	.59	.35	.22	.15
	6	....	....	....	17.	12.3	8.49	5.66	4.25	2.83	1.7	1.17	.85	.57	.42	.28	.17	.11	.07
	7	....	....	15.6	9.17	6.55	4.58	3.58	2.29	1.56	.92	.61	.46	.36	.23	.16	.09	.06	.04
	8	26.9	13.45	8.96	5.38	3.84	2.69	1.79	1.34	.9	.54	.36	.27	.18	.13	.09	.05	.03	.02
	9	16.7	8.35	5.57	3.34	2.39	1.67	1.11	.83	.56	.33	.22	.17	.11	.08	.06	.03	.02	.01
75 hp.	3	....	....	....	....	....	....	....	....	....	....	....	20.4	13.6	10.2	6.8	4.07	2.55	1.7
	3½	....	....	....	....	....	....	....	....	....	....	14.8	11.1	7.4	5.55	3.7	2.22	1.39	.93
	4	....	....	....	....	....	....	....	....	....	13.	8.67	6.5	4.33	3.25	2.16	1.3	.81	.54
	4½	....	....	....	....	....	....	....	20.1	13.4	8.05	5.36	4.02	2.68	2.01	1.34	.8	.5	.34
	5	....	....	....	....	....	26.4	17.6	13.2	8.8	5.28	3.52	2.64	1.76	1.32	.88	.53	.33	.22
	6	....	....	....	....	18.2	12.73	8.47	6.36	4.24	2.54	1.7	1.27	.85	.64	.42	.25	.16	.11
	7	....	....	....	13.8	9.82	6.87	4.57	3.44	2.29	1.38	.92	.69	.46	.34	.23	.14	.09	.06
	8	....	....	13.4	8.05	5.75	4.03	2.69	2.02	1.34	.8	.54	.40	.27	.2	.13	.08	.05	.03
	9	25.1	12.6	8.35	5.06	3.59	2.51	1.67	1.26	.83	.51	.33	.25	.17	.13	.08	.05	.03	.02
	10	16.5	8.25	5.5	3.3	2.36	1.65	1.1	.82	.55	.33	.22	.17	.11	.08	.05	.03	.02	.01

Contributed by A. M. Wasbauer

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IDEAS · FROM · PRACTICAL · MEN

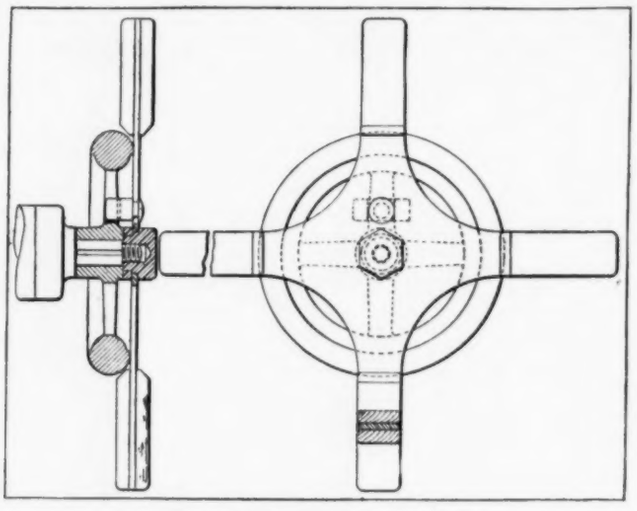
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

An Auxiliary Wheel for the Tailstock

By J. E. Fenno

An addition to the regular hand wheel on the tailstock of a lathe is shown in the illustration. It is for use in drilling and provides a better purchase for the operator, enabling him to increase production with less manual effort.

The auxiliary wheel is made of heavy sheet steel, and is attached to the tailstock screw by a special nut that



The auxiliary wheel in place

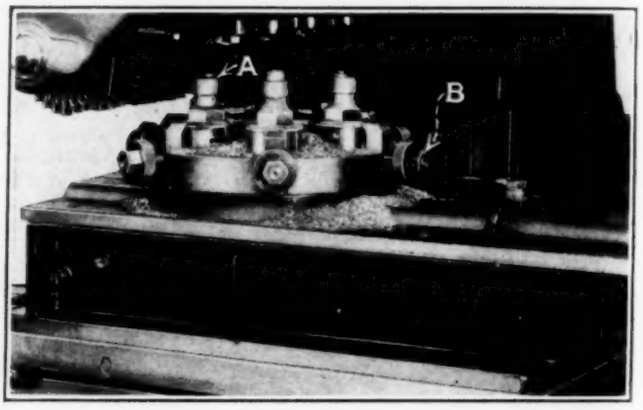
replaces the regular one for securing the handwheel. The nut is shouldered to acommodate the inner ends of the spokes, which are a free fit thereon and are held in place by a collar driven onto the nut.

A fork, riveted to one of the spokes, spans a spoke of the handwheel and acts as a driver. The hand grips are pieces of wood riveted to the outer ends of the spokes, in the same manner as the handle of a butcher knife is riveted to its blade. The device can be put in place or taken off in a few seconds. When the auxiliary wheel is removed and the regular nut is in place, the tailstock is in its original condition.

Automatic Fixture for Milling Hexagon Faces

By Louis L. Locke

Automatic indexing synchronized with the reciprocating motion of a slide is the feature of the milling fixture illustrated. It is used in milling the hexagon faces of bonnets for globe and angle valves. The rotating part



An indexing reciprocating type milling fixture

of the fixture holds six workpieces, three of which are undergoing operation at the same time. At each indexing, the fixture revolves one-sixth of a revolution, so that the piece *A* entering the path of the cutters at the left of the gang, has two of its faces straddle milled. At the next station, the same piece has two adjacent faces milled and finally at the last setting the remaining two faces are milled. When the fixture is fully loaded and in operation, a piece is completed at each index.

Movement of the slide is controlled by a universal drive shaft connected to the feed gears of the machine. This arrangement allows the table to remain stationary, since all the movement is carried on in the fixture. Each piece of work is located from a stud, and is held by two jaws that are operated by a leadscrew such as shown at *B*. Different sizes of work are accommodated by changing the jaws to suit, and by changing the spacing of the side-milling cutters. The loading and unloading requires approximately 15 sec., and the production obtained is 240 pieces per hr. The fixture is used in a No. 2 Milwaukee milling machine.

A Bending and Jeweling Fixture

By Charles H. Willey

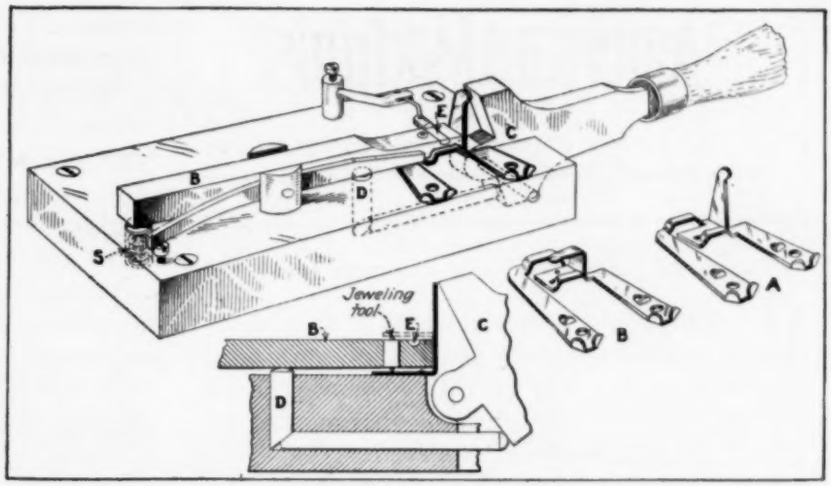
In the manufacture of small, dashboard-types of automobile ammeters, there is considerable competition to get the business of the automobile industry. Sometimes it is just a clever piece of machine design, a special fixture, or tool that makes the difference between failure and success on a bid for business at a split-penny profit.

We experienced this on our manufacture of the Ford ammeter for jobbers' replacement sales. The price was low to us, and outside of the scrap brass and a "penny per meter" profit, we had nothing for our efforts. In other words, to keep hands and equipment going, we bid on it below the other fellow, and if we stubbed our

toe on a run of parts we had no leeway. I preface this article with the above to show how the bending and jeweling tool sketched herewith saved us many dollars and aided us to "get away with" the job.

The coil of the ammeter also formed a support for the movement of the meter, that is the pivot, armature, pointer and balance assembled, it being necessary to have a jewel or pricked spot in the support in which the pivot ends swing. The support is shown at *A* before bending the top part over, and at *B* it is shown after forming and jeweling.

The action of the forming arm *B*, and the operating lever *C* is shown in the cross section. Depressing the lever *C* by hand forces in the pin *D*, raising the end of the arm *B* so that the piece can be placed in position. Raising the lever *C* then makes the bend and forms spots for the jewel. When the lever is again brought down to the loading position the spring *S* forces the arm *B* back, causing the cam *E* to turn in its seat and spread the piece of work enough to clear the jeweling tool on each side for easy removal.



An accurate bending and jeweling fixture

Previous to the design of this fixture we were forced to make two operations of this one job, one to bend it, and another to put in the jewel impressions, and we rejected 20 per cent for poor alignment of the jewel impressions. As the press of work of this particular piece requires six press operations up to this point, 20 per cent waste at this point meant a loss on our bid.

Staples for Holding Paper on Drawing Boards—*Discussion*

By B. Heyman

To enter into a lengthy discussion on the advisability of using staples as on page 591, Vol. 68, of the *American Machinist*, adhesive paper strips as suggested on page 824, Vol. 68, or any other method as against the old-fashioned and proven method of sticking thumb tacks through the sheet into the drawing board reminds the writer of the old phrase "much ado about nothing."

Where is the time economy and what is the real advantage? Particularly are there no advantages when the drafting room is subjected to frequent changes of temperature and humidity with resultant stretching and warping of the drawing. Thumb tacks are cheap and give long service. Their readjustment to suit the drawing makes them flexible in use. What more can the draftsman desire?

Making Erasures on Tracing Cloth *Discussion*

By Matthew Harris

The several discussions under the title given above, in late issues of the *American Machinist* appear to have narrowed down to the permissible use of the steel eraser.

Whether or not it is necessary to use the steel eraser, depends largely upon the sharpness of the ruling pen and how hard the draftsman bore down upon it when inking the lines. If the blades of the pen cut into the tracing cloth, the use of the knife is essential. Even then it may not be possible to make a clean erasure, and a hole may be made in the cloth in the attempt.

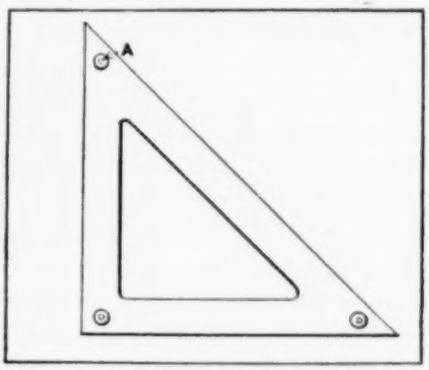
Various erasers have been made to obviate the use of the steel knife. A very good one was finely-spun glass, set into a case, or holder, having a rectangular opening. The glass could be fed out by a screw in the same manner in which the leads in the many patent pencils are regulated.

I remember reading some years ago, I think it was in the *American Machinist*, about a draftsman who attached an ordinary typewriter eraser to a small fan motor by means of a flexible shaft. Touching the tracing with the revolving eraser, he was enabled to erase inked lines easily and quickly. Of course, in using such a device, a sensitive touch and a steady hand would be necessary, otherwise a hole would be ground through the cloth in short order.

An Improved Triangle

By A. Gentner

Every draftsman has sometime or other smeared his drawings due to the ink running from the ruling pen on to the triangle. This danger may be overcome by the method shown in the accompanying illustration. Three small holes are drilled, as at *A*, in an ordinary triangle, one near each corner. A thumb tack is placed in each hole and the end peened over. In this manner the triangle will always lie above the drawing that the draftsman is working on. Now, if the ink runs from the ruling pen to the edge of the triangle, it will not smear the drawing, but will run to the under side of the triangle.



An improved triangle

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

"Isolation" Applied to Cincinnati Meeting

LET people be marooned together on a desert island and they soon get to know each other very well, according to certain well known classics. Change the scene—put them together on a boat—and the same result is achieved. The recent national meeting of the Machine Shop Practice Division of the A.S.M.E. gave indisputable proof of the truth of this assertion.

A total of forty hours on the steamer "Cincinnati," on the Ohio river, brought out a tremendous capacity for sociability on the part of the two hundred engineers and executives taking the trip. More good fellowship, more real acquaintance, and the making of more friendships were evident than it appears can accompany a meeting on shore in a place where the people do not have to keep together.

As an experiment the Cincinnati meeting was of great value to men responsible for meetings and programs of societies and associations. If a poll of those attending had been taken, the vote would have measured a complete success. Praises for the meeting will be sung in many places. The principle of isolation, upon which the meeting was based, should be studied whenever meetings are planned, and applied with some frequency.

Color Standardization for Machinery

IS THE wide variety of colors that is being called for on automobiles, machines, and utensils a repudiation of simplified practice? This is a question that has been asked the Division of Simplified Practice of the Department of Commerce, and is already being taken note of by the National Machine Tool Builders' Association, which is circulating its members with the idea of evoking opinions on the standardization of colors for machine tools.

If simplified practice means the reduction of waste by the reduction of variety where variety is unnecessary and immaterial, then the multiplication of colors to get away from the gloomy black and drab gray that have characterized machinery and tools is certainly not a repudiation. Pleasant surroundings, which include clean and bright machinery, are now generally recognized as meaning dollars and cents in the profits of a business.

Workmen who came from the tenements and dull surroundings of the old mill towns reflected their mode of living in unrest and inefficiency. The average present-day workman who has a brighter home atmosphere and lives more in the colors and variety of nature unquestionably brings a finer spirit into the plant. The turn to more color in machinery looks like an important step in improving those surroundings where men spend half of their waking hours. Variety in color is not a repudiation of simplified practice, but an introduction of new factors. Simplified practice can now step in and ascertain by study just what colors will give the desired effects, and by standardization of these it can eliminate immaterial differences that would complicate production economy.

Exchanging Ideas

INTERCHANGE of trade knowledge is credited, by keen foreign observers, to be the outstanding reason for manufacturing development in this country. True, we have great natural resources and a large home market for most products. But without the interchange of ideas as to methods, none of our industries would have advanced to their present state of efficiency.

The automobile industry is an outstanding example of this broadminded type of management. Engineers and production men exchange plant visits with great frequency. None expect to see experiments as to new designs or methods, although the latter are seldom kept under cover to any great extent. But methods that have been found good enough to become common practice are open to the whole industry.

Interchange of these ideas has been greatly aided by the technical and business press. The editors of the *American Machinist,* for example, travel over 70,000 miles a year to visit plants of various kinds, and to study prevailing and proposed methods of manufacture. They then pass on this information concerning modern shop practice to those who cannot see at first hand.

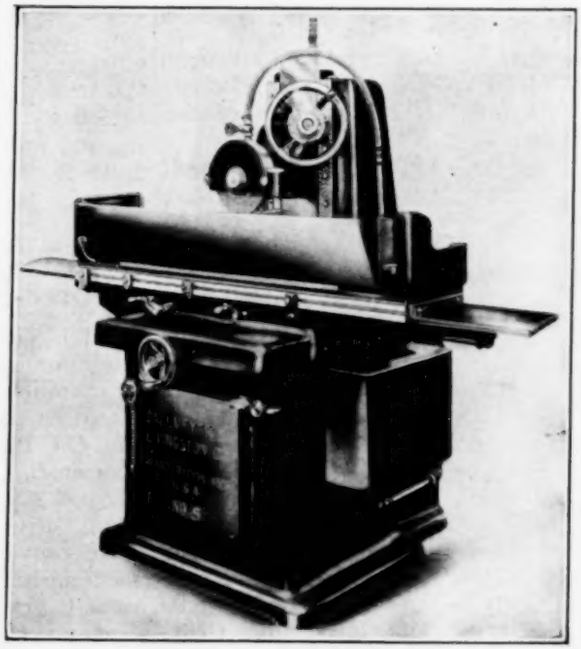
Most manufacturers are glad to have engineers from other plants see their methods, because they know they will get other ideas in exchange. In the same way progressive machine builders are willing to let us publish their methods, realizing that they in turn benefit by seeing the methods of others. They have learned that, in attempting to keep a few good ideas *in,* it is very easy to keep more ideas *out.*

· SHOP · EQUIPMENT · NEWS ·

Gallmeyer & Livingston Nos. 4 and 5 "Grand Rapids" Hydraulic-Feed Surface Grinders

RAPID and fine adjustments of the wheelheads are furnished on the Nos. 4 and 5 "Grand Rapids" surface grinders which have been placed on the market by the Gallmeyer & Livingston Company, Grand Rapids, Mich. The illustration shows the No. 5 grinder which is a motor-driven machine complete with pump, tank and splash guards for wet grinding. For rapid adjustment of the wheelhead through considerable movement, a large handwheel is used, which gives direct action through a worm and wormgear to the elevating screw. The large handwheel is graduated in $\frac{1}{4}$ thousandths, with a movable pointer, which can be set for convenient reading. When, however, it is desired to get accurate readings for grinding to close limits, a fine adjustment is used. Turning the smaller handwheel or knurled hand knob in the center of the large handwheel provides a back-geared action to the elevating mechanism. The disk in the center of the handwheel has a graduated dial ring which can be easily set at zero in relation to the pointer mounted on the spoke of the large handwheel. Both the inner and outer wheels turn, but the graduations on the inner wheel are arranged to read on the moving pointer, thus giving a vernier effect. By this means it is easy to get readings of adjustments in tenths of a thousandth, with the graduations over $\frac{1}{8}$ in. apart. Variable table travel is provided by the Oilgear feed. The Oilgear unit is connected to a cross-feed engine mounted under the saddle, which is so arranged that, at each reversal of the reciprocating table, it actuates the cross-feed mechanism. It may be set to operate at either end of the reciprocating table stroke, or at one end only, and also to feed either in or out. The amount of cross feed for each reciprocation is also adjustable. The rate of travel varies from almost nothing to 55 ft. per min. This range provides rates of speed to produce either very fine finishes with extreme accuracy or ordinary tolerances.

The one-piece base casting weighs over 1,600 lb. The spindle head is a heavy casting, fitted to the vertical ways, and it carries a heavy spindle with a minimum of overhang for the wheel. The front bearing is 2 in. in diam., by 8 in. long, with an auxiliary rear bearing $1\frac{3}{4}$ in. in diam. by 5 in. long. These bearings are of bronze, lubricated from an oil reservoir, and easily adjustable for wear. The spindle is heat-treated. Both the wheel bearings and the elevating screw are located directly in the center of the vertical ways, thus avoiding any side strains in elevating. The elevating screw is of large size, being $1\frac{1}{2}$ in. in diameter.



Gallmeyer & Livingston No. 5 "Grand Rapids" Hydraulic-Feed Surface Grinder

Either machine may be equipped with a magnetic chuck having a working surface equal to the table area of the machine to which it is to be fitted. Wheels 10 in. in diam. and having either $\frac{3}{4}$ or 1 in. face are used.

SPECIFICATIONS

	No. 4	No. 5
Automatic table travel, longitudinal, in.	26	38
Automatic table travel, transverse, in..	12	12
Working surface of table, in.....	10x24	10x36
Vertical movement of wheel head, in...	13¾	15¾
Maximum distance from wheel to table, under a 10-in. wheel, in.....	12¼	12¼
Net weight, dry grinding equipped, lb..	4,025	4,250
Standard motor size, hp.....	5	5

Gleason Spiral Cutter Truing Fixture

CIRCULAR cutters may be checked on this truing fixture which has been placed on the market by the Gleason Works, Rochester, N. Y. The fixture is for use in connection with the spiral bevel gear generator manufactured by the above company. Heretofore cutters have in most cases been checked on the cutting machine. This device shown in the illustration not only releases the more expensive machine for production, but provides a more accurate

Fig. 1—Gleason Spiral Cutter Truing Fixture

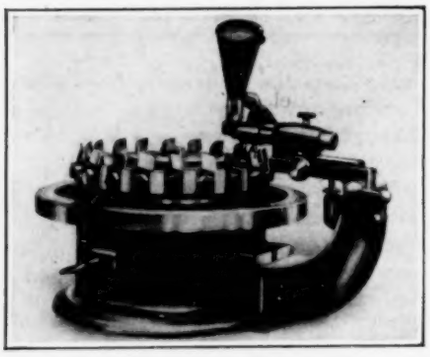


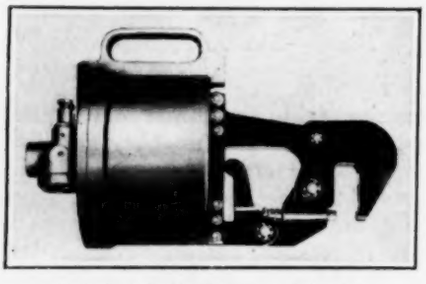
Fig. 2—Close-up of the Gleason Spiral Cutter Truing Fixture

and convenient means for doing this work.

The cutter truing fixture is simple in design, consisting of a spindle made to accommodate the various sizes of spiral bevel gear cutters. A large handwheel attached directly to the spindle is used for turning the cutter to the desired point for checking. The spindle is then locked in position by a lever at the front of the fixture. The spindle is mounted in precision ball bearings, and is ground in its own bearings. The runout according to the manufacturer is thus reduced to within 0.00005 in. Several different measuring instruments may be used in connection with this fixture, all of which read to 0.0001 inch. By the use of a finger device operated through a system of levers, one indicator is used for checking both the inside and the outside cutting blades. The fixture is mounted on a rigid base which is adjustable for height.

"CP" 3½- and 6-Inch Squeeze Riveters

Noiseless operation and uniformity of driving are the features of these "CP" squeeze riveters which have been placed on the market by the Chicago Pneumatic Tool Company, 6 East 44th St., New York, N. Y. They are built in two sizes. The 3½-in. size has a capacity of 5 tons. It will drive $\frac{1}{8}$-in. steel rivets, $\frac{5}{32}$-in. duralumin rivets, and $\frac{3}{16}$-in. aluminum rivets. Its weight is 8 lb. The 6-in. riveter has a capacity of 10 tons, and will drive $\frac{3}{16}$-in. steel rivets, $\frac{5}{16}$-in. duralumin rivets, and $\frac{1}{8}$-in. aluminum rivets. Its weight is 16½ lb. Each size requires but one man to operate it.



"CP" 6-Inch Squeeze Riveter

These riveters may be used for compressing rivets in the manufacture of aeroplanes and light sheet-metal products. A large variety of sizes of interchangeable yokes can be furnished to meet any requirement within the capacity of the machines. This feature not only saves time but permits the use of one machine for a great variety of work. A metal guard completely covers the working parts. This guard is not shown in the illustration, having been left off to show the operating features.

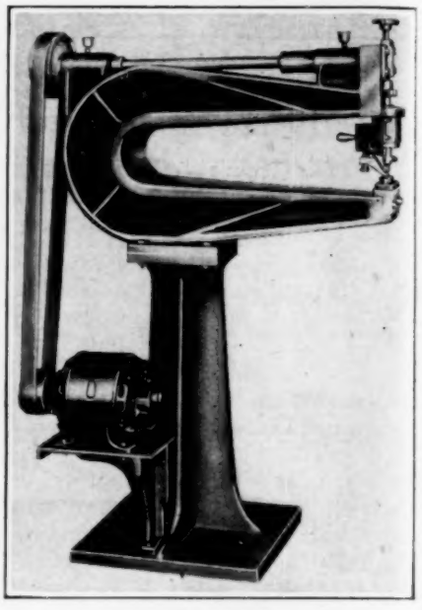
Jones "True Blue" Semi-Steel Pulleys

Machine-molded pulleys of semi-steel have been placed on the market by the W. A. Jones Foundry & Machine Company, 4401-51 West Roosevelt Road, Chicago, Ill. These pulleys are obtainable in solid, split, split-arm and double-arm types. They are available in standard stock sizes from 2 to 60 in. in diam., although not all sizes of each type are stocked. Pulleys up to 12 ft. in diam. can be made.

Pulleys with flanges or web centers, tight and loose pulleys, and rubber-covered pulleys, can be obtained. None of these are intended to be run at more than 5,000 ft. per min., whether balanced or not.

Gray No. 00 30-Inch Metal Cutter

Sheet steel up to $\frac{1}{8}$ in. in thickness can be cut to any form or split on this Gray No. 00 metal cutter which has been placed on the market by the W. N. Savage Company, Knoxville, Tenn. As shown in the illustration, the cutter is of compact construction. Its depth of throat is 30 in., and the cutting speed is 30 in. per min. According to the manufacturer, cutting is accomplished without springing and buckling the sheet, all edges being left true and square.



Gray No. 00 30-Inch Metal Cutter

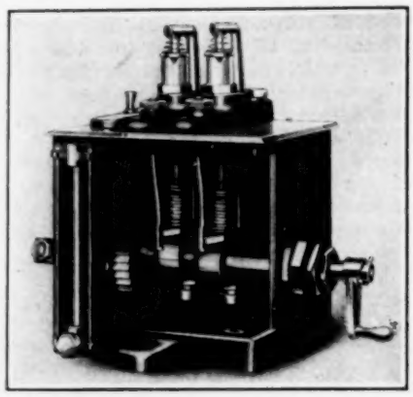
The turret head will turn in any direction. It carries a cutter mechanism that consists of a reciprocating cutter used in connection with a lower die. High-speed steel is used for the cutter, which is held rigidly in a tool holder, arranged so that the tool can be set down to the proper length after grinding. A ¾-hp. motor running at 1,800 r.p.m. furnishes power. For either shearing or nibbling, the speed of the cutter is 900 strokes per min. Dimensions are as follows: height 62 in., length 46 in., and width 20 in. The weight is 1,015 lb., net.

American Model F Force-Feed Lubricator

Oil is pumped by this force-feed lubricator only when the machine is in operation. The device has been placed on the market by the American Oil Pump & Tank Company, Cincinnati, Ohio. As shown in the illustration, it is arranged for left-hand drive, although right-hand drive can be obtained by reversing the camshaft assembly. The lubricator is made in various sizes giving from one to sixteen feeds. The reservoir capacity for the size having one feed is 3 pints and that of the

one having sixteen feeds is 18 pints. A separate pumping unit is provided for each feed. Any unit may be removed for cleaning or inspection without disturbing the other units, and without breaking the oil line. All moving parts are inclosed within the tank and operate in oil. Each feed can be regulated.

The body is made of cast iron reamed to fit the primary plunger and the force plunger. The feed is regulated by adjusting the stroke of the plungers. A hexagon shaft runs lengthwise through the reservoir, and is fitted with a cam for each pump unit. As this shaft is rotated, the cam raises the plungers on the delivery stroke and permits a spring acting through a plate to lower the plungers on the suction stroke. The plate and plungers are raised to the same height at all adjustments of the stroke. A bushing on the outer end of the hexagon shaft is attached to some reciprocating part of the machine to be lubricated by means of a pawl and ratchet. A heating chamber



American Model F Force-Feed Lubricator

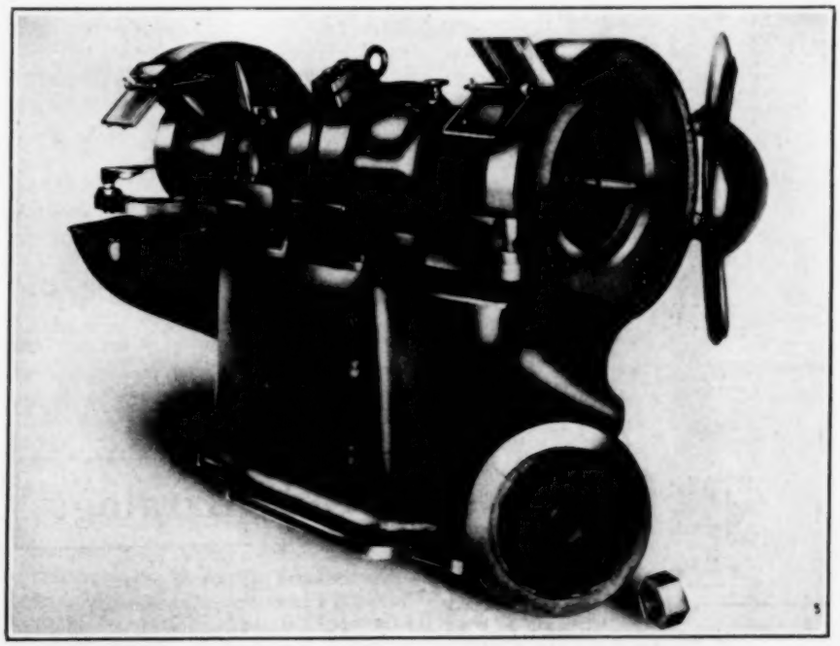
is provided in the reservoir with openings tapped for ⅜-in. standard pipe so that steam can be conducted through it to heat the oil if it is found necessary. Since the pumping units are of the positive-displacement type the correct amount of oil is delivered to the required point, regardless of the temperature or viscosity of the oil. From three to twelve drops can be fed per unit per stroke. Strokes vary from 4 to 15 per minute.

Any pumping unit can be removed from the cover and the tank by the removal of only one bolt and one screw. No other mechanism is disturbed, the remaining units continuing to function as before. The oil line fed by the removed unit is not touched or affected in any way. The oil outlet from the lubricator outfit being at the back of the tank, makes the oil line independent of the pumping unit. The oil line remains full due to a check valve at tank outlet, and the oil will again flow immediately when the pumping unit is replaced in the tank.

Standard Electrical Tool Company's Heavy-Duty Snagging Grinder

Rubber-body high-speed grinding wheels are used on these heavy-duty grinders, which have been placed on the market by the Standard Electrical Tool Company, Cincinnati, Ohio. The illustration shows the 7½-hp. grinder, which is equipped with 24x3-in. rubber-body wheels with a 12-in. bore. The machine is made in three sizes, 5, 7½, and 10 hp. The wheel flanges are 12 in. in diam., the inner flange being keyed to the armature shaft. This shaft is made of nickel steel, and runs in four SKF ball bearings mounted in dustproof chambers.

The emery-wheel guards are of the hinged-door type with exhaust connections. The guards are fitted with spark breakers as well as polished, wire-glass eye shields. Ring wheels from 20 to 30 in. in diam. may be accommodated on these grinders.



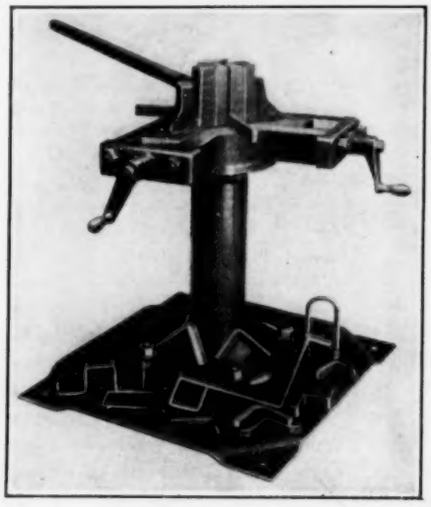
Standard Electrical Tool Company's 7½-Hp. Heavy-Duty Snagging Grinder

Naudain "Ever Ready" Bending Machine

Flat, round or square bars can be bent to various angles on this machine, which has been placed on the market by John E. Naudain, Sparrows Point, Md. There are no changes in parts to be made for the different jobs; no wrenches are required; no set screws, stops, nor tapered wedges need be moved; and no adjustment need to be made for different thicknesses of material. The dies open and close the same on both angles.

This machine has a two-way bending head and two working jaws. Each jaw works independently of the other, and it opens and closes the gripping die with equal distance at right angles. The bending head and jaws are 6 in. high, and will take stock up to any thickness that can be bent by handpower, approximately 6 x 1 in. Dies of various angles may be changed readily to suit different jobs.

The machine is portable. It requires about 30 sq.in. of floor space, and the lever bar may be turned up



Naudain "Ever Ready" Bending Machine

out of the way while not being used. The column and baseplate form a foundation, and are furnished as part of the machine. The two-way bending head and the working jaws are made of cast steel which has a tensile strength of 80,000 lb. per square inch.

Cullman Single and Double Speed Reducers

Both single and double speed reducers in sizes from ¼ to 5 hp. have been placed on the market by the Cullman Wheel Company, 1344-54 Altgeld St., Chicago, Ill. Fig. 1 shows a cross-section of the single type, while Fig. 2 gives a cross-section of the double model. Both models have the housing, cover, and motor base made of cast iron, the motor base being bolted to the reducer housing. The motor base is provided with four adjustable studs so that the motor may be lined up accurately. No coupling between the reducer and the motor is used, the motor shaft extending into the reducer housing and carrying the chain sprocket.

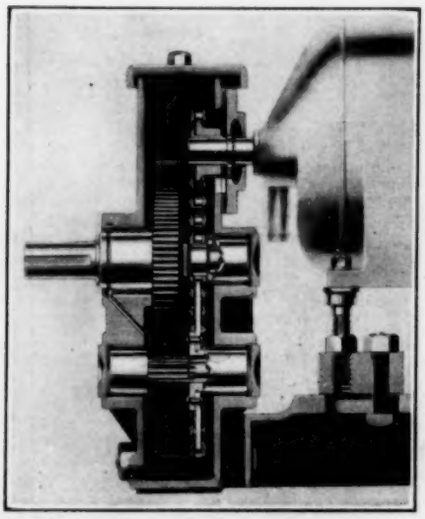


Fig. 1—Sectional view of the Single-Type Cullman Speed Reducer

The first reduction in both types is accomplished by a standard diamond roller chain and sprockets. The speed can be reduced from two to six times in this step. The larger sprocket is mounted on a shaft having the second pinion cut thereon. As shown in Fig. 1, this pinion drives the main spur gear on the power output shaft. All bearings are phosphor bronze. The gears, shafts and sprockets are of hardened steel. The

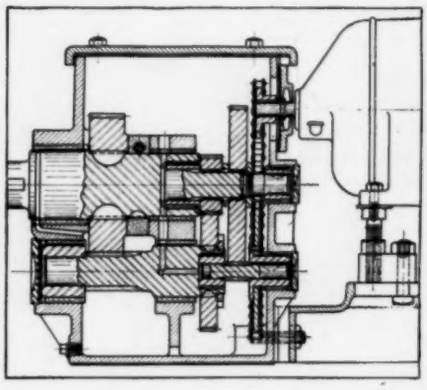


Fig. 2—Sectional view of the Double-Type Cullman Speed Reducer

chain emerging from the oil furnishes a spray of lubricant to the gearing and bearings. It also acts as a flexible coupling.

Referring to Fig. 2 it will be noted that the large sprocket shaft and the first large driven gear shaft run in bearings formed by cylindrical bores in the two large shafts at the left. Passages are drilled in the large shafts for conveying lubricant to these bearings. A system of internal ribbing with bearing surfaces holds these shafts in alignment.

Trade Catalogs

AUTOMOBILE TIMING DRIVE. The Diamond Chain and Manufacturing Co., Indianapolis, Ind., has published a folder entitled, "The Modern Timing Drive," which announces a drive claimed to be radically different from those at present in general use on motor cars. The important points brought out are the reduced weight, simplicity of construction compactness, and that the pieces are individually heat-treated especially for their work.

BENCH TOOLS. Hardinge Brothers, Inc., Berteau and Ravenswood Avenues, Chicago, Ill., has published catalog No. 15, and two other pamphlets on the line of "Cataract" precision bench lathes and attachments. In addition, a line of Cataract bench milling machines is shown. Photographs are used to illustrate each machine and attachment. Specifications and constructural details are included. Catalog No. 15 contains 116 10x6½-in. pages.

CHUCKS AND DIEHEADS. The Apex Machine Co., Dayton, Ohio, has published catalog No. 5, entitled "Precision Production Tools," which describes and illustrates quick-change chucks for drilling and tapping in both the positive and friction-drive types, universal joints, and self-opening dieheads. In addition, nut setters and stud setters are shown. Tables of sizes are given for each device. The catalog contains twenty 8½x5½-in. pages.

FLEXIBLE COUPLINGS. The Falk Corporation, Milwaukee, Wis., has issued Bulletin No. 180, showing the line of Falk flexible couplings not included in the issue which it supersedes, and lists one additional size of coupling, the No. 20½C. It describes the CS type developed for close-coupled applications, and also the CH type added to the standard line for high-speed work. Both of these types retain the same operating principle as the standard series. Tables of dimensions are given for each type. The catalog contains 16 11x8½-in. pages.

HOBBING MACHINES. Gould & Eberhardt, Newark, N. J., have published bulletin No. 178 on manufacturing gear hobbing machines Nos. 12HS and 24HS. These machines are intended for the accurate and rapid production of spur gears, splines, sprockets and worm-wheels. Photographs and descriptions of important assemblies are given. Specifications and equipment are listed. The catalog contains eleven 11½x8½-in. pages.

INSERTED TOOTH CUTTERS. The Goddard & Goddard Co., Detroit, Mich., has published a catalog which shows the constructional details of inserted tooth cutters with taper dovetail blades. Photographs of these cutters in use are given. Tables are included showing the sizes of taper shank end mills with taper dovetail inserted teeth, SE series, and also for the heavy-duty channeling cutters with taper dovetail inserted teeth, Series T. The catalog contains nineteen 8x5-in. pages.

NEWS OF THE WEEK

Program of Safety Education Is Resulting in Saving of Lives, Suffering and Lost Time

Over 300 speakers address seventeenth annual Safety Congress

NEARLY 6,000 delegates attended the seventeenth annual Safety Congress at five hotels in New York, on October 1 to 5. The 110 meetings of the thirty odd divisions of the congress were addressed by about 325 speakers. The profusion of ideas may be summarized by saying that the aim of safety work is to make people "safety-conscious," largely by organized education.

Reports, both in the addresses and in discussions from the floor, indicate that the program of education is resulting in large annual savings of life, suffering and lost time. The Council is far from satisfied with present conditions, however, and maintains that the 25,000 industrial workers who were killed and the hundreds of thousands who were injured last year, suffered, in most cases, needlessly. More than 4,600 members of the Council have demonstrated that most accidents can be prevented through safety methods.

Willis H. Booth, president of the Merchant's Association and vice-president of the Guaranty Trust Co., of New York, speaking from the subject "The Humanics of Industry," said:

Record of Accidents

"During the year ended June 30, 1927, more than 95,000 human beings lost their lives in accidents occurring in the factories, and on the streets and highways of this country. In New York State factories alone, almost 99,000 people were injured so severely that they received money compensation, 1,042 of those 99,000 died as a result of their injuries. These accidents, most of which I venture were preventable, cost New York State in excess of $100,000,000. Charging deaths and permanent disabilities with a loss of 1,000 weeks each, injured employees were absent from work a total of more than 2,000,000 weeks.

"Here is a condition, the relief of which demands the interest and effort of every human being, whether he sits in the president's office or works at a bench.

"Here is a situation in which there can be no major controversy. The conservation of life and limb is of prime importance to both employer and employee, for death and disability cause loss to them both."

Some of the papers and addresses were:

Metals Section

Safety from the Viewpoint of Management, by R. M. Roosevelt, vice-president, Eagle Picher Lead Co.; Safety from the Viewpoint of Supervision, by Dominic Samuel, foreman, Youngstown Sheet & Tube Company.

Correction of Unsafe Practices in Foundries, by Nelson H. Kyser, safety engineer, Studebaker Corporation of America; Developing a Safe Human Factor in our Industries, by L. A. Hartley, director, educational department, National Founder's Association.

The Placement of Men, or What the Surgeon Can Do, by A. W. Colcord, M.D., plant surgeon, Clairton Works, Carnegie Steel Company.

Debate: That the Foreman Is Responsible for Accidents that Occur in His Department, by J. A. Voss, director, safety and compensation, Central Alloy Steel Co., and Michael P. Grady, foreman, Pennsylvania Railroad Shops.

Power Press Section

The Woman Operator in the Punch Press Department, by Ruth I. Stone, chief of women's personnel department, operating branch, Hawthorne Works, Western Electric Company.

Drop Forge Safety Links; a series of five minute talks by: E. J. Wallman, safety engineer, Great Lakes Forge Co.; M. A. Kroger, safety engineer, Chevrolet Forge Division, General Motors Corporation, and J. C. McLogan, director of personnel, J. H. Williams & Company.

The Growth of Safety in the Drop Forge Industry, by L. M. Rice, district chief engineer, Liberty Mutual Insurance Company.

Training the Foreman to be a Teacher, by M. J. Kane, engineer in charge of training, plant department, American Telephone & Telegraph Company.

Automotive Section

What is it all About?—The Foreman and Safety, by Phillip J. Bowen, foreman, annealing department, Michigan Steel Corporation; Safety Through Contests, by E. H. Cotcher, superintendent of safety, The Murray Corporation of America.

Good Housekeeping for Safety and Production. General, by R. G. Knutson, Commissioner, Industrial Commission, State of Wisconsin; Production Stores, by J. L. Juhe, superintendent of planning, Chrysler Corporation.

Manufacturing Department, by J. B. Gibson, safety and health division, Western Electric Co.; Introduction of the New Employee, by A. F. Dunnebacke, safety director, General Motors Corporation; What Are You Going to Do About It? by Dr. Harry Myers, superintendent of personnel, Frigidaire Corporation.

Steam Railroad Section

Safety in the Shop, by W. P. Mountford, safety inspector, Pennsylvania R.R. Company.

Discussions followed many of the papers. One of the points brought out was that the number of accidents to employees in some companies is greater out of the shop than in. In other words, these shops are safer than the streets and home.

A. F. Dunnebacke, safety director of the General Motors Corporation, staged two methods of introducing a new employee to his job. This illustrated the hard boiled foreman, and the foreman who knows how to impress a man with the necessity for safety in the shop, to interest him in his job and to give him a feeling of loyalty to the organization. Every new employee must read a short folder on safety and sign a coupon to show that he has read it. At the close of his first day the new man is required to spend a half hour with the safety director, on company time, at which he is impressed with the necessity for care, and many of the causes of accidents are pointed out to him. Following this talk there were discussions on rehabilitation of injured employees, double-duty guards and mechanical safeguarding.

Put Ideas into Use

Dr. Harry Myers, superintendent of personnel of the Frigidaire Corporation, spoke on the necessity of putting new ideas obtained at conventions into use, the danger of having a mind that automatically closed itself against new methods, the tendency to resent criticism. He pointed out that as 80 to 90 per cent of the scrap was caused by improper or insufficient teaching of the men, no firm could afford to overlook the value of proper instruction, not only for boys but for men already on the job.

Safety in air transport was emphasized from many angles. Design, construction, and airports were discussed in various phases. Two papers of particular interest were "Communications

as an Aid to Safe Flying," by Dr. J. C. Hunsaker, and that on "Instrument Navigation in Fog Flying," by Lt. A. F. Hegenberger of U. S. Army Air Corps. The former pointed out the need and growth of radio communication with aircraft and the other how modern instruments aided in flying blind, as well as the need for still other instruments.

Buyers and Sellers Offer Code of Ethics for General Industrial Adoption

Stress need for mutual confidence as basis for co-operation

THAT full confidence between both buyer and seller is the greatest need of American Business today, was the unity of feeling expressed at a meeting of eminent business executives held recently at the Commodore Hotel, New York City. The group consisted of R. W. Babson, Babson's Statistical Organization; L. F. Boffey, editor, *Purchasing Agent's Magazine*, New York City; A. M. Bowman, purchasing agent, Humble Oil & Refining Co., Houston, Texas, and president, National Association of Purchasing Agents; L. A. Jones, vice-president and purchasing agent, New York Power & Light Corporation, Albany; W. A. Marshall, president, W. A. Marshall & Co.; W. W. Nichols, president, Machinery Builders Society; G. A. Renard, secretary-treasurer, National Association of Purchasing Agents, New York; R. M. Roosevelt, vice-president, Eagle-Picher Lead Co.; A. L. Salt, president, Graybar Electric Co., New York, and E. L. Shaner, editor, *The Iron Trade Review*. It was the nucleus of a committee appointed at a conference held last May of representative manufacturers, sales executives, purchasing agents, and business paper editors which had been called by the National Association of Purchasing Agents to consider the subject of "Profitless Prosperity," the responsibilities of the purchasing agent for the lack of profits by many manufacturers, and, if possible, to arrive at a practical and workable solution.

Basis for Co-operation

The purpose of the committee was to continue the work begun at the earlier conference. In its deliberations, the committee brought out that the much-talked-of effective co-operation can only be based on mutual confidence. Sellers, for example, should be given fair estimates of future consumption needs in order to gage their production as far as possible and thus prevent radical fluctuations within their industry. Buyers, on the other hand, maintained that confidence in the seller's fairness, quality of merchandise, delivery promises, prices, etc., must also be established as a basis for co-operation. Both sides agreed that organization policies were too often entirely concerned with selfish interests and that an industrial code to which both buyers and sellers could subscribe should be made a basis for confidence and co-operation. Such a code, previously prepared by a group of the N.A.P.A. and endorsed by a number of very large organizations to whom it had been submitted, was unanimously adopted. The code or platform of sales and purchasing co-operation is given below.

Unnecessary sales and purchasing expense is an economic waste, a tax on legitimate industry. Its elimination will assure satisfactory profits to the producer, economy to the consumer, and greater efficiency in commercial relations.

We recognize that the concern which buys must also sell, that buying and selling are companionate functions, that sound commercial transactions must be mutually profitable, and that co-operation between buyer and seller will reduce the cost of purchasing, sales and distribution with consequent benefits to industry as a whole.

In furtherance of these principles, we subscribe to the following standards in our buying and selling.

FIRST: To buy and sell on the basis of *value*, recognizing that value represents that combination of quality, service and price which assures greatest ultimate economy to the user.

SECOND: To respect our obligations and neither expressly nor impliedly to promise a performance which we cannot reasonably expect to fulfill.

THIRD: To avoid misrepresentation and sharp practice in our purchases and sales, recognzing that permanent business relations can be maintained only on a structure of honesty and fair dealing.

FOURTH: To be courteous and considerate to those with whom we deal, to be prompt and businesslike in our appointments, and to carry on negotiations with all reasonable expedition so as to avoid trespassing on the rights of others to the time of buyers and salesmen.

FIFTH: To avoid statements tending to injure or discredit a legitimate competitor, and to divulge no information acquired in confidence with the intent of giving or receiving an unfair advantage in a competitive business transaction.

SIXTH: To strive for simplification and standardization within the bounds of utility and industrial economy, and to further the development of products and methods which will improve industrial efficiency.

SEVENTH: To recognize that character is the greatest asset in commerce, and to give it major consideration in the selection of customers and sources of supply.

EIGHTH: To adjust claims and settle disputes on the basis of facts and fairness, to submit the facts to arbitration if a mutual agreement cannot be reached, to abide by the decision of the arbiters, and to resort to legal measures in commercial disputes only when the preceding courses prove ineffective.

NINTH: To provide or accept no gifts or entertainment in the guise of sales expense, where the intent or effect is to unduly prejudice the recipient in favor of the donor as against legitimate competitors.

TENTH: To give or receive no bribes, in the form of money or otherwise, in any commercial transaction, and to expose commercial bribery wherever encountered for the purpose of maintaining the highest standard of ethics in American industry.

It is the aim of the Committee to secure wide-spread adoption of the code by representative buying and selling factors throughout the country. In addition to other means of carrying on the work, the 57 affiliated associations of the N.A.P.A. will be asked to sponsor joint conferences with sales executives in all parts of the country and to secure adoption of such a policy by the influential business organizations in their districts. It is pointed out that approval of the code by purchasing agents or sales forces separately would be of little value, but its adoption by both will be very valuable in eliminating costly industrial practices which create much criticism.

In addition to those named above, the committee also includes E. T. Gushee, purchasing agent, Detroit Edison Co.; T. W. Harris, Jr., E. I. duPont de Nemours & Co., and Earl Whitehorne, commercial editor, *Electrical World*. Mr. Jones, last year's president of the N.A.P.A., is chairman of the committee.

Iron and Steel Institute to Meet in New York

The American Iron and Steel Institute is to hold its thirty-fourth general meeting on October 26 at the Commodore Hotel, New York, N. Y. The following technical program has been provided:

"An Acoustic Laboratory for the Testing of Music and Other Steel Wires," by W. B. White, acoustic engineer, American Steel & Wire Co., Chicago.

"Uniformity, Continuity and Magnetic Testing," by A. V. deForest, research engineer, American Chain Co., Bridgeport, Conn.

"Steel Requirements of the Aircraft Industry," by H. J. French, senior metallurgist, Bureau of Standards, Washington.

"Recent Observations of Some European Iron and Steel Conditions," by C. A. Meissner, United States Steel Corporation, New York.

"The Present Status of Structural Steel Welding" by F. T. Llewellyn, president American Welding Society, New York.

"Steels Used by the Automotive Industry," by W. J. MacKenzie, vice-president, Interstate Iron & Steel Co., Chicago.

Following the technical session, a banquet will be held in the evening.

Screw Thread Commission to Publish 1928 Report

The second revision of the Report of the National Screw Thread Commission, to be known as the 1928 Report, has been approved for publication and is now being printed. Those desiring copies should write the Commission, which has headquarters at the Bureau of Standards, Washington D. C. The standards have been renamed "American National."

The general arrangement of the last

(1924) report has been retained with the addition of sections covering the following items: wrench head bolts and nuts, and wrench openings; other screw, bolt, and nut proportions by reference to certain specifications of the American Engineering Standards Committee and the Federal Specifications Board; standard practice for Acme screw threads; screw threads for oil country drilling equipment by reference to specifications published by the American Petroleum Institute; standard hose connections for welding and cutting torches; rolled threads for screw shells of electric sockets and lamp bases; and a 12-pitch thread series for special applications.

Revisions of the previous specifications comprise: The addition of sizes from 1½ to 3 in. to the fine thread series but with coarser pitches than those originally published in the progress report of 1921; increase of the tolerance on minor diameter of nut, over the range of sizes smaller than 1⅛ in., of the coarse and fine thread series; the insertion of the 3 in. 3½ threads per in., in the coarse thread series; the substitution of tables of specific pitch diameter tolerances for threads of special diameters, pitches, and lengths of engagement in place of the method of determining such tolerances by adding increments together, thus establishing consistency with the pitch diameter tolerances specified for the regular thread series; and revision of head proportions of wood screws. The specifications for pipe threads are carried over in this report in their original form pending completion of the work of the new A.E.S.C. Sectional Committee on the Standardization of Pipe Threads.

All matter relating to threading tools has been removed from the specifications but included in the appendix. Other new material added to the appendixes includes the following: American Gage Design Committee Standard designs of blanks for plain and threaded plug and ring gages; specifications covering class 5, wrench fit for threaded studs; common practice as to thread series and claass of fit for screws, bolts, and nuts; and wire methods of measurement of Acme threads.

New England Industries Discussed at A. S. M. E. Gathering in Boston

Plans for Spring Meeting Considered

APPROPRIATELY enough, the great majority of the papers presented at the Boston regional meeting of the American Society of Mechanical Engineers, Oct. 1 to 3, dealt with problems in New England plants. The technical sessions were held at the Statler Hotel.

At the council meeting, which was presided over by vice-president Robert E. Newcomb, superintendent Worthington Pump & Machinery Corporation, Holyoke, Mass., plans for the next spring meeting, to be held at Salt Lake City, July 1 to 4, 1929, and for the 50th anniversary meeting, to be held at Washington during the week of April 7, 1930, were discussed briefly.

Approval of the revised constitution of the American Engineering Standards Committee was also voted.

Technical sessions were held by the Aeronautics, Applied Mechanics, Machine Shop Practice, Materials Handling, Management, Power, Railroad, and Wood Industries Divisions, and by the Committee on Education and Training for the Industries. There was also a session of the Special Research Committee on Strength of Gear Teeth at the laboratory of the Department of Engineering Standards and Measurements, Massachusetts Institute of Technology, where the testing work on gear teeth has been carried on under the direction of Professor Earle Buckingham.

Of interest to men engaged in the metal working industries were papers by Charles K. Tripp, supervisor of apprentices, General Electric Co., Lynn Works, and Walter S. Berry, Director of Training, Scovill Mfg. Co., Waterbury, on apprentice selection and training; by William J. Fortune, National Shawmut Bank of Boston, "Progress in New England"; by Jerome R. George, Morgan Construction Co., "Proper General Management for Industry"; by A. Willgoos, Pratt & Whitney Aircraft Corporation, "The Wasp Engine," by F. W. Mesinger, Norma-Hoffman Bearings Corporation, "Ball and Roller Bearings in Aircraft"; by A. B. Kinzel, Union Carbide & Carbon Research Laboratories, Inc., "Evaluation of the Technical Worth of a Steel From Physical Test Data"; by Alden M. Drake, Greenfield Tap & Die Corporation, "Internal Grinding Development"; by T. F. McEnneny, Universal Winding Co., "Methods and Processes in a Textile Machinery Plant."

Van Norman to Market Its Own and Stanley Lines of Tools

Since October 1, all products of the Van Norman Machine Tool Co., of Springfield, Mass., are being sold direct instead of through the Van Dorn Electric Tool Co., Cleveland. The Van Norman company will also market to the automotive trade all electric tools made by the Stanley Rule & Level Co., New Britain, Conn., as well as the Stanley-Atha line of chisels, hammers, vises, screw drivers and other small tools. A policy of restricted distribution through jobbers only has been adopted. Leo F. Hunderup has been appointed sales manager.

Union Chain to Buy Out American High Speed Chain Company

Announcement has been made by the officials of the Union Chain & Manufacturing Co., Sandusky, Ohio, that, subject to the approval of the stockholders, they have acquired control of the American High Speed Chain Co. of Indianapolis, Ind., and will combine the two companies.

The Union Chain company, established in 1913, builds elevating and conveying machinery together with a line of steel sprocket chain for such purposes. The American High Speed Chain Co., established in 1916, is engaged in the manufacture of a line of silent or high-speed chains and smaller pitch steel roller chain together with the necessary sprockets, all of which are used primarily for power transmission purposes. The products of the two companies thus supplement each other.

As soon as the approval of the stockholders is had, the machinery and equipment of the American High Speed Chain Co. will be moved from Indianapolis, Ind., to the Sandusky plant of the Union Chain firm, a new unit having been provided to permit the proper installation of such equipment.

Two executives of the American High Speed Chain Company, J. C. Howe, president, and W. A. McCosh, vice-president, will move to Sandusky and become a part of the new organization. The executives of the company will be: Fred Emmons, president and treasurer; J. C. Howe, vice-president; Walter Hay, vice-president; E. F. Emmons, secretary.

Apprentice Training Discussed at Milwaukee

The practical advantages to the manufacturer of training apprentices were brought out by C. S. Thompson, chief engineer of the Union Special Machine Co., Chicago, at the annual apprenticeship dinner of the National Metal Trades Association at Milwaukee, September 24. Mr. Thompson indicated that his company has built up its organization from graduates of shop apprentices courses. About 145 executives and officials of metal trade shops atended the dinner.

By means of charts, W. J. Fairbairn, secretary of the Milwaukee Branch of the N. M. T. A., pointed out that the number of apprentices in the district had increased from 450 to nearly 1,000 during the last six years; that the great majority of apprentice graduataes remained at work at the trade which they learned; and that apprenticeship seems to have a favorable effect on labor turnover, since those shops in the district in which apprenticeship is established have a much lower rate of turnover than those in which no apprentices are trained.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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LAST week's happenings in the world of business were somewhat obscured by the smoke of the political battle, but all the available data appear to indicate increased activity, and cheerfulness is predominant. Brokers' loans on September 30, as reported by the Stock Exchange, were at a new high record, but neither this increase nor the cautionary speeches delivered at the bankers' convention in Philadelphia had much effect upon the speculators, who have become optimistic fatalists.

Early in the week when call money touched 10 per cent, the stock market yielded slightly, but it soon recovered its poise, and while the warnings at Philadelphia may have restrained buyers, it is plain that they did not induce much liquidation. All the economists agree that an excessive proportion of America's banking resources is being used to carry securities, and that the advance in money is a danger signal. But no one seems to take alarm, and Wall Street continues to attract all the credit that can be pried loose in this country and in Europe.

Of course, stocks that pay 5 per cent or less cannot be carried indefinitely with money that costs from 7 to 10 per cent, but a decline in interest rates after the middle of November is confidently expected, and if this expectation is realized a widespread revival of speculation may accompany the improvement in business that is already under way.

Perhaps the most impressive feature of the week is the improvement in the textile trade. Raw silk and silk fabrics are higher; so are wool and most woolen goods; and there is a distinct improvement in the market for cotton yarns and cotton cloth. Out of the travail of the last two years, the cotton textile industry appears to be emerging with an increased appreciation of the value of co-operation and consolidation. One result is the great Lancashire merger, reported to include mills having eight million spindles. Another is the combination of eleven mills and two finishing plants that is said to be impending at Fall River. A third is the unity with which the New Bedford manufacturers have acted in dealing with the strike there. It was settled in the past week by the employees accepting a 5 per cent reduction in pay.

Meanwhile, raw cotton is nearly two cents above the season's low, and consumers seem disposed to buy freely on any decline that may follow the Government estimate to be issued October 8.

Sugar is another article at which some would-be buyers seem to be squinting with a willingness to believe that the low price at which it is selling makes it a good purchase.

Turning from trade to industry, we get a view that is also encouraging. *Iron Age* says that the iron and steel industry is on an unusually stable basis. The F. W. Dodge Company reports that the construction contracts awarded in thirty-seven states during September contemplate an expenditure which exceeds the same month last year by 13 per cent. The output of the automobile industry is again ahead of the record for this season of the year. The shoe factories, the lumber mills, the clothing manufacturers and the machine shops are also well employed, and it is really hard to find a dark spot on the commercial and industrial map of the United States.

Contemplating an outlook so satisfactory, it is natural to ask when and how it will be changed. No one can answer this question with finality. With brief interruptions and occasional setbacks, the tide of prosperity has been rising since 1921. In the interval we have had the collapse of the Florida boom, and a depression in the agricultural Northwest, which led to hundreds of bank failures. But neither of these visitations, nor any of the less important misfortunes that have overtaken particular localities seem to have seriously shaken the business structure of the country, and it is easy to argue that it is securely founded on a rock.

It is to be hoped that this is the case, but those who have had any experience with hard times in the United States will continue to keep their weather eyes open, although it must be admitted that good business appears to be indicated for the balance of the year, and as long thereafter as one's vision of the future can reach.

In Europe, the prospect is nearly as cheerful as in the United States. The world will soon be celebrating the tenth anniversary of the armistice. Since November 11, 1918, the people of Europe have certainly learned to be more proficient in the arts of peace, and their proficiency is beginning to bear fruit in an increase of earning and buying power that spells prosperity. Insofar as this country is concerned the prosperity of Europe means a better demand for what we have to sell, and it is a fact of great importance to us.

If the dream of funding German reparation payments in a huge bond issue of eight or ten billions of dollars should be realized, the psychological effect might be electrifying, and mark the commencement of an era in high finance that would dwarf everything that had preceded it. But, as yet, this vision is far from being a reality, although it suggests a possibility that should not be ignored, and may act as a sustaining influence in moments of reaction.

WHAT'S DOING IN INDUSTRY

MACHINE tool builders are entering the last quarter of the year with a record business behind them and with all indications pointing to a brilliant finish. Without a doubt, two related industries, automobile and airplane builders, have been largely responsible for this unusual year, but the chief characteristic of the market for the last month, all ove rthe country, has been miscellaneous buying from well scattered sources.

MILWAUKEE, for example, reports for this week that a large number of small orders is going to keep up the present rate of machine tool production until at least the end of the year. There less automotive shop purchases are noted, but in Cleveland this class of buyer is occupying the center of the stage. This buying is reflected in sales in New England, Cincinnati, Philadelphia and Chicago.

DETROIT continues to comment on the remarkable expansion in the automobile business, although there was a letup in employment for the first time in months, as the saturation point is being reached. General sales in Cleveland have mounted steadily from month to month, with September volume the highest this year. In Chicago, also, September sales exceeded those of August, but in New York the volume was slightly less, due to exceptional orders in the previous month.

GENERAL inquiry in New England makes the outlook promising, and optimistic hopes for the future are also expressed in Philadelphia, based on present sales and inquiries. A highly favorable outlook is also reported in Chicago, and a good volume of inquiries are noted in Cincinnati. About the only weak spot is railroad buying, which continues light.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW ENGLAND

The current week continued encouraging to machine tool builders in the New England district. The automotive industry is buying fairly steady, with orders being confined to one or two tools. Inquiries are promising and have been representative of a wide purchasing field. Orders for new and used equipment held up well through the first week of October.

A general increase in orders has featured the brass and copper industry in the New England territory. It is another indication of the general soundness of industrial conditions in the section. Leaders in this field, which opened the year none too promising, now anticipate a high level of business throughout the last quarter from orders already booked.

The railroad industry in New England is confining expenditures at this time to a wide program of construction, and has not been in the market for shop equipment to any extent, a condition which is apt to be true for some time. Any buying beyond occasional replacements is highly improbable for some time. This industry is also giving a good measure of technical consideration and time to the coal rate controversy. The endeavor to decrease rates, wherever successful, must effect the net income and will cause a continuation of economy programs.

CLEVELAND

The machinery and machine tool market is gathering more momentum each day. Sales during the first week of October overshadowed the previous week. September has proved to be the best month of the year for some dealers and manufacturers. A dealer of standard and used tools cites his sales record as proof of the upturn in the market. August, usually a dull month showed a 40 per cent increase over July while September showed a 30 per cent increase over August.

The automotive industry is the biggest buyer of tools at the present time. One order for 40 automatics was received from one of the largest manufacturers in the Detroit district.

Increased business is expected for the fourth quarter of this year. This assumption is based on the increased number of inquiries being received. The greater number of them are for one or two pieces, but there are a few scattered lists that call for a number of machines.

MILWAUKEE

The metalworking equipment trade has exhibited no important changes in trend during the first week of October, and the conditions obtaining during the greater part of September still govern the progress of the industry. There are few large lot orders, but a great many small bookings, calling for one, two or three items, which form a substantial aggregate and insure the further continuance of the present rate of production, until the close of the year and even beyond.

Although the demand from the automobile industry represents a smaller volume than during the recent heavy buying movement, local tool manufacturers still have a large quantity of orders to fill, and they are receiving fresh orders for single tools or a few that are required to fill out the lots placed some time ago. It is generally believed that the bulk of these requirements has been met for the present, and further substantial buying will depend largely upon the manner in which extensive manufacturing schedules planned for the winter are absorbed next spring. It may be said that the slackening in retail passenger car sales that usually sets in in October and ordinarily does not revive until March and April has been of lesser force than usually, and is materially less than a year ago.

The call for equipment from general metalworking shops is good, and this is accepted as an indication of the soundness of the general industrial situation. Foundry and machine shop employment is still at the recent peak, and skilled machine workers are very scarce. There is some night work in the machine tool group, and numerous makers of automobile units and parts are forced to work overtime schedules to keep deliveries as close as possible to specifications.

The outlook for the remainder of the year is favorable. There is, of course, no expectancy of a repetition of the heavy buying of the summer-months in the near foreground, but prospects are for a steady volume of business from widely diversified sources.

DETROIT

From all indications Detroit and all of Michigan will enjoy its most prosperous year in 1928, and the machinery and machine tool business will come in for its full share of this unusual prosperity. September was an excellent month, and, though it did not break as many records as some of the earlier months of the year, almost of the dealers were very busy. Employment has dropped a little, but the general attitude is extremely good throughout the state.

The automotive industry is experiencing a condition that is really remarkable. Not only are all of the large and small plants working at capacity, but all of the small tool, die and fixture shops are also very busy. There are many new shops starting up, and all of them have orders for work, some having a great many jobs ahead.

Ford, Studebaker, Chrysler-Dodge, Graham-Paige, Packard, Cadillac, Chevrolet and Hupmobile are making expansions from time to time, and are buying equipment of various kinds. At present most of the orders are for tools and for replacement equipment.

The Chevrolet plants at Bay City and Saginaw are adding machinery and tools. The Jackson Steel Products, another division of General Motors, is expanding. All of the body companies, including the Hayes in Lansing, are doing a great deal of business, and are making purchases. The automotive parts and accessories business has been setting new high records for production during the past two months.

The new and remarkable Diesel-type aircraft engine developed by the Packard Motor Car Co. will probably be in production within a few weeks. The Ford Motor Company is receiving many large orders for the giant, three-motored, all-steel airplanes. The Detroit Gasket Co. has purchased the plant of the Springman Paper Products Co., and is planning an expansion program. Hudson is reaching new production records. Graham-Paige, Chrysler-Fargo and General Motors trucks sales are going up rapidly, both in the domestic and the foreign field. The Durant Motor Co. of Flint, Mich., is soon to move into its new and enlarged plant.

PHILADELPHIA

An optimistic view of the machinery and machine tool business for the future is held by manufacturers, dealers and agents throughout the Philadelphia area. This is based upon actual sales during the last two weeks and upon inquiries which have come to offices in this market from a well scattered area and from diversified lines of industry. There is a feeling that the remaining months of 1928 will witness continued activity throughout this section, and that the future of the business rests upon a substantial foundation.

Sales in the Philadelphia district during the last two weeks included lathes, drilling machines, tapping machines, binding equipment and turret lathes. The purchases were by an automobile concern, the name of which was not revealed by the firm with which the orders were placed. The sheet-metal industry has been active in the Philadelphia market with purchases of press equipment, with prospects of continued activity from that line. Steel plants have also been doing some buying, and there were some sales of single tools for replacements. Dealers in used machinery also reported a brisk business with orders from general industrial lines. There have also been some purchases from foundries in this area.

CHICAGO

The outlook for machine tool business in October, according to the consensus of opinion among machinery men, is highly favorable. The volume of sales for September in some cases exceeded that of August, while others closely approached it. Inquiries during the last week have increased as compared with the week preceding. Present indications point to the issuance of new lists by agricultural machinery and tractor manufacturers within a short time, the International Harvester Co., the Nash Motors Co., and the Allis Chalmers Manufacturing Co., being mentioned in particular as among those who will require large additions to their equipment. Industrialists are buying freely, and machine shop operators are inquiring for various tools for replacement purposes. There are no new developments in the railroad situation, such orders for equipment as are materializing being of no outstanding importance. Business in used tools continues satisfactory, and is holding up well. Optimism is generally expressed by the trade that business will continue good until the close of the year, and that the presidential election, however it may result, will have no bearing on the machine tool industry, one way or the other.

CINCINNATI

A very fair demand in the past week is reported by the majority of the machine tool manufacturers in the Cincinnati district, and taking the industry as a whole there was a slight gain in sales in the period. The lull of the previous week was followed by a market recovery, it is stated, and it is thought that business has resumed an upward trend. "Things are normal with us and orders and inquiries are holding up very well," said one manufacturer. "Sales are at a level that is better than fair, and prospects look good to us," stated another. "In the past month we had a gain of about

twenty per cent, and the indications are that we will do as well or better the present month." explained a third.

Selling agents report that although machine tool users in local and adjacent territory are still very conservative in the matter of buying, with a strong tendency to defer the placing of orders as long as they can, the sales resistance is beginning to weaken, and therefore sales are increasing. This branch of the trade, taking it as a whole, is optimistic as to the immediate future.

The sustaining feature of the past week's market was the sale of single tools and replacements, but here and there was an order for two or three pieces of equipment. The great majority of the sales were to general machinists and miscellaneous users, located in all sections of the country, whose requirements were well diversified in the matters of sizes and types. Scattering orders for single tools were received from concerns in the automotive industry and its allied trades, and a limited amount of business came from railroads.

The great majority of the manufacturers report that a good volume of inquiries were received in the week, the major portion of them being from general users.

NEW YORK

Little change is noted in the New York market in machine tools in the past week over that reported for the past month. The demand for machine tools, with but few exceptions, continues at the high level established many months ago. While only one dealer stated that the week has been the dullest in some time, another indicated that the volume of sales during the week had been exceptionally high, and others stated that business was most satisfactory.

All agreed that there is considerable industrial activity in the surrounding territory, and while not all the shops are buying additional equipment, a large number of firms are inquiring for and purchasing needed equipment. As in the previous week, two firms are furnishing the chief source of interest for the time being, E. W. Bliss in Brooklyn, and R. Hoe & Co. in New York. Neither apparently, have placed any actual orders recently, but that both are potential sources for machine tool orders is taken for granted, the one because of preparations for building of the Bristol "Jupiter" engine, the other because of its removal to new quarters.

Railroad buying remains light, although the New York Central R.R. bought a wheel lathe for its Avis shop, and the Erie has inquiries out for similar equipment. No considerable activity is expected on the part of the roads until after the first of the year.

The Niles Tool Works Co. reports the sale of a 42-in. x 14-ft. planer. The Pratt & Whitney Co. did a large volume of business in the past week. Among the sales reported were: three 6-in. vertical shapers, three 6 x 20-in. thread millers, two 4½ x 12-in. thread millers, three jig borers, two profilers, one Sigourney drill, two lathes, seven No. 1 deep-hole drills, two 6-spindle deep-hole drills, an 8-in. rotary surface grinder and a 5-in. production hand miller.

BUFFALO

The generally favorable conditions reported within recent weeks still prevail and machine tool and electrical equipment dealers and manufacturers detect a steadiness in the market which has not been heretofore noticeable for some time.

No large inquiries are reported but there is a large volume of small purchases, largely of a maintenance character, and the demand seems to be constant and varied in nature. This is equally true in the machine tool and electrical equipment fields.

Demand seems to be at a low ebb, however, in the contractors' equipment field. But this is largely a seasonal condition. The Donner Steel Co. of Buffalo, has ordered three 300-hp. oil-electric locomotives to be built jointly by the Ingersoll-Rand Co., the General Electric Co. and the American Locomotive Company.

Mortenson Chief Engineer of Cutler-Hammer

N. L. Mortenson has been appointed chief engineer for the Cutler-Hammer Manufacturing Co., Milwaukee, effective September 1. T. E. Barnum, former chief engineer, has been appointed consulting engineer for the company. Mr. Mortenson has been connected with

N. L. Mortenson

Cutler-Hammer for 21 years, the last 5 of which have been as assistant to Mr. Barnum. He was born in Denmark and received his technical education there, and in Germany. Articles by him have appeared frequently in the technical press and he has delivered numerous papers before electrical societies. He is a fellow of the American Institute of Electrical Engineers and a member of the Association of Iron & Steel Electrical Engineers.

Clemson Recognizes Jobbers as Legitimate Distributors

In a letter addressed to the trade, dated Oct. 1, Clemson Bros., Inc., of Middletown, N. Y., state that the success of their business has been predicated upon a policy of strict adherence to recognizing the hardware jobber and the mill supply house as the legitimate distributer of their product. The firm has no interest, the letter states, in the taking of direct consumer business, inasmuch as it is in direct competition with the distributer, and wants large direct consumer purchases to be made through the proper channels.

"Hand-To-Mouth" Buying to Be Investigated

With a view to checking up the reported wide-spread change in purchasing methods during the past ten years, the Institute of Economics is making a study of "hand-to-mouth" buying. Purchasing agents are being asked how far ahead their company has been in the habit of placing orders for two of the more important commodities purchased in 1914, 1918, 1922, 1924, 1926 and 1928; what proportion the approximate average inventory for those years has been of the year's needs; whether there has been any important change in inventories carried in proportion to annual requirements; whether there has been any definite improvement in the company's purchasing technique during the past five years; whether the company is buying more frequently and in smaller quantities, and, if so, why.

Financial Notes

Net profit of the Ross Gear & Tool Co. for the first nine months of 1928 is estimated by E. A. Ross, president, in excess of $600,000 after all charges, including federal taxes. This would be equal to $4 per share of common stock. These earnings are greater than those for the full year 1927 when net profit was equal to $2.65 a share. The company has no bonds or preferred stock outstanding. The management reports that shipments for the third quarter this year will be 112 per cent greater than for the corresponding period a year ago.

Authorized 200,000 shares no-par stock of Sullivan Machinery Co., Michigan City, Ind., have been listed on the Boston Stock Exchange. There are 190,046 shares outstanding. Stock pays dividends of $4 a share per annum. Net earnings, after depreciation, taxes, etc., in 1927 were equal to $4.75 a share on stock outstanding at the end of the year; in 1926 $4.94 a share, and in 1925, $3.81 a share.

Personals

HAROLD L. CRULL has been appointed assistant sales manager of the Oilgear Co., of Milwaukee.

A. B. SWARTZ has been appointed purchasing agent for the Safety Car Heating and Lighting Co., New Haven, Conn., in place of J. J. Mallay, resigned.

F. A. BUCHDEA and H. C. STUCESSEY have been elected vice-president and treasurer, respectively, of the Eaton Axle & Spring Co., Cleveland.

H. C. WEIDNER, general manager of the Townsend Co., New Brighton, Pa., has been elected president in place of the late R. T. Townsend.

FRED M. YOUNG, president of the Young Radiator Co., Racine, Wis., has been commissioned a captain in the Specialist Reserve, Air Corps, U. S. Army.

F. H. MOYER, formerly vice-president of the Mackintosh-Hemphill Co., manufacturer of rolling mill machinery, has been elected president of the company in place of J. R. Speer, resigned.

D. M. STEMBLE has been elected vice-president and general manager of the Canonsburg (Pa.) Steel & Iron Works. J. M. Watson, former general manager has resigned.

JAMES J. CARI has been transferred from foreman of the bore grinding department of the New Departure Manufacturing Co., Bristol, Conn., to complete charge of front wheel bearing operations.

E. F. SCOTT, formerly of the Austin Co., Cleveland, has been appointed secretary-manager of the Ohio Foundries Association, Inc., succeeding A. J. Tuscany, who recently became manager of the Gray Iron Institute.

L. DUDLEY CARR is now assistant superintendent of the Auburn (N. Y.) works of the International Harvester Co. in place of A. P. Jones, who has been made superintendent of the Canton (Ill.) plant.

L. W. STEVENS, who was assistant superintendent of the Veeder Manufacturing Co., Hartford, Conn., prior to its merger with the Root Co., Bristol, Conn., is now superintendent at the Hartford plant of Veeder-Root, Inc., the consolidated company.

DAVID STRAUSS, president of the Continental Iron & Steel Co., New York City, has been elected chairman of the New York Chapter of the Institute of Scrap Iron and Steel, one of the first of ten chapters to be established in the East.

ARTHUR D. EATON, formerly of Dodge Brothers, Inc., has been elected vice-president of Aluminum Industries, Inc., Cincinnati, Ohio. Mr. Eaton will assume active charge of the sales activities and will be located in the new Detroit office of the company in the Fisher Building.

HAMPTON SMITH, 506 McBee Ave., Greenville, S. C., who has for some years been identified with the textile mill machinery and supply business in the southeastern district, is engaged in the forming of a company which will establish a plant at Greenville, probably the early part of next year, to manufacture textile machinery and parts.

PRINCE CHICHIBU, brother of the Emperor of Japan, who recently was married to Miss Setsuko Matsudaira, daughter of the former Japanese Ambassador to the United States, has been named Honorary President of the World Engineering Congress to be held in Tokio in 1929, according to advice just received by Elmer A. Sperry, chairman of the American Committee to the Congress.

W. BRUCE PIRNIE, chairman of the board of directors of the Cheney Bigelow Wire Works, Springfield, Mass., has been elected treasurer of the company. Guy M. Peterson, vice-president, succeeds to the vacancy left on the board by the resignation of W. B. Sheehan. Ralph E. Freeman, assistant general manager, was elected to the board and made clerk of the board. The company declared its regular quarterly dividend and shows assets of $400,000 with liabilities of $8,170.

Obituaries

J. C. YARNELL, Western sales manager at Detroit of the Clark Brothers Bolt Co., Milldale, Conn., died on Sept. 27, at Kalamazoo, Michigan.

ALFRED JAMES, proprietor of the Pioneer Foundry, LaCrosse, Wis., died Sept. 30 at the age of 74 years. He was born in Shrewsbury, Shrosphire County, England, coming to America in 1869 and joining his brothers in the Pioneer Foundry business in 1874.

ROBERT LAIDLAW, 80 years old, founder of the Laidlaw-Dunn-Gordon Co., which was later merged with the Worthington Pump & Machinery Corporation, died on Oct. 6 at Brockville, Ont. Mr. Laidlaw retired in 1899. He was at one time director of the Board of Public Service of Cincinnati.

FREDERICK STEELE BLACKALL, vice-president and general manager of the Taft Peirce Manufacturing Co., Woonsocket, R. I., died on Oct. 5. He was formerly president of the Blackall & Baldwin Co., a machinery contracting firm, and a director of the Central Electric Heater Co. From 1911 to 1914, he was president of R. Hoe & Co., of New York. Since 1903 he had been president of the Interchangeable Parts Co. and had held his last position with the Peirce company.

WILLIAM T. MACFARLANE, founder of the Bridgeport Crucible Co., Bridgeport, Conn., died recently following a prolonged illness. Mr. Macfarlane was a native of Massachusetts and came to Bridgeport in 1886 and established himself in the crucible business in 1887. In 1904 the Bridgeport company purchased the Taunton Crucible Co., Taunton, Mass., which was operated as a branch plant. In 1916 the business was sold to a Buffalo concern. Mr. Macfarlane was president of the Bridgeport Crucible Company for 30 years and in 1916 retired.

Business Items

The Arthur Jackson Machine Tool Co., of Toronto, Ont., has moved into a new office, showroom, and warehouse at 9 Front St., East, Toronto.

The Briggs Manufacturing Co., of Detroit, will reopen its Cleveland plant about Nov. 15. It is expected that new equipment will be necessitated.

The Cleveland Planer Co., Cleveland, Ohio, has purchased the good will, patents, drawings, tools and the rights to manufacture and sell the "Emco W" bench power punch press, formerly built by the Enterprise Machine Tool Co., of Chicago.

The Doehler Die Casting Co., New York, N. Y., on Oct. 1 purchased the permanent mold casting equipment, dies, molds and related tools of the Metal Mold Castings Co., of Buffalo, which is to cease business.

The Vanadium Corporation of America, of New York, N. Y., has opened up a branch office at 2245-46 Henry W. Oliver Bldg., Pittsburgh, Pa., under the direction of J. Alfred Miller, Jr., general manager of sales of the Vanadium Corporation.

Lindsay & Conrad, Inc., Dyersburg, Tenn., announce the recent chartering of this company with a capital stock of $30,000 for the distribution of machinery, machine tools, mill supplies, etc., in the Tennessee district. R. F. Lindsay, Sr., and K. S. Conrad are the incorporators.

The Spence Machine & Supply Co. has been recently incorporated at Parkersburg, West Va., for the distribution of machinery, tools, mill supplies, etc., in that district, it has been announced by W. T. Elliott, 10 Camden Place, Parkersburg, one of the incorporators.

A new plant of the Linde Air Products Company, located at 125 Settlement St., Akron, Ohio, started producing oxygen on September 11. This plant will supply the nearby demand for oxygen used in welding and cutting and will be operated under the direction of A. Deagon, superintendent.

Directors of the Mt. Vernon (Ill.) Car Manufacturing Co. last week elected Ralph K. Weber president of the company succeeding W. C. Arthurs, whose death occurred recently. Mr. Weber has been vice-president of the company the last 20 years.

The Harriman Manufacturing Co., Harriman, Tenn., and the W. J. Oliver Plow Co., Knoxville, Tenn., have been recently consolidated, and following removal of the Oliver equipment to the plant at Harriman, to be completed about Nov. 15, will operate as the Harriman Manufacturing Company.

The Black & Decker Manufacturing Co., Towson, Md., has been holding working demonstrations of its product in nearly all the large cities of the country. At these clinics portable electric drills, hammers, screw drivers, tappers, valve refacers and attachments were shown. The clinics lasted about ten days, and jobbers' salesmen, executives and consumers attended.

The Simonds Worden White Co., with headquarters at Dayton, Ohio, has been formed by the consolidation of the A. A. Simonds-Dayton Co., of Dayton, the L. & I. J. White Co., of Buffalo, the Worden Tool Co., of Cleveland, and the R. J. Dowd Knife Works, of Beloit, Wis. The controlling organization intends to operate each of the original plants and to handle orders through each plant.

The Highway Trailer Co., Edgerton, Wis., has taken a 10-year lease of extensive space in the former Moline Wagon Co. plant, now owned by the city of Stoughton and used as an industrial community. The space will be used to accommodate the body department of the Edgerton plant, manufacturing both wood and steel dump bodies for trailers. Andrew McIntosh is vice-president.

The American Ironing Machine Co., manufacturer of the "Super Simplex" ironing machine, with its plant at Algonquin, Ill., has been reorganized. E. C. Peter, of Algonquin, for 23 years vice-president, is president; M. J. Broderick, of Chicago, for eight years assistant secretary and treasurer, vice-president and general manager; W. T. Peter, of Algonquin, for 20 years secretary, is treasurer; B. C. Getzelman, of Elgin, capitalist, is secretary.

The Waterbury Steel Ball Co., Waterbury, Conn., was recently purchased by the Federal Manufacturing Co., Poughkeepsie, N. Y. The sale was outright and while the price was not announced it is known that the Waterbury company is capitalized for $200,000. The business will be continued at Waterbury where the working force has just been increased by the addition of 100 men. Bearing contracts are on the companies books from Studebaker, Ford, Reo, Graham-Paige, Hudson, Moon and Auburn motor car companies and the Western and General Electric companies.

Receivership has been instituted against the Litchfield Manufacturing Co., Waterloo, Iowa, by the Commercial National bank of that city, which issued $300,000 gold notes in 1925 secured by mortgage upon the agricultural implement manufacturing company. The firm was established in 1908 by the late H. L. Litchfield and his brother Edgar C. Litchfield but defaulted upon payment of the bonds, which had been distributed through the bank. The bank has been named receiver, under $25,000 bond, and will continue to operate the plant in hope of disposing of the property as a going concern.

Forthcoming Meetings

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Welding Society. Fall meeting and exposition, Exhibition Hall of Commercial Museum, Philadelphia, Pa., Oct. 8-12, in conjunction with "National Metals Exposition" of the American Society for Steel Treating. Miss M. M. Kelly, secretary, 29 West 39th St., New York City.

Institute of Metals. Division of American Institute of Mining and Metallurgical Engineers. Annual fall meeting during National Metal Week, Oct. 8-12, Benjamin Franklin Hotel, Philadelphia. W. M. Corse, secretary, 810 18th St., N. W., Washington, D. C.

American Gear Manufacturers' Association. Semi-annual meeting, including joint session with the Machine Shop Practice Division of the American Society of Mechanical Engineers, Statler Hotel, Buffalo, N. Y., Oct. 11-13. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

Society of Industrial Engineers. Fifteenth annual convention, Rochester, N. Y., October 17-19, in conjunction with the Industrial Management Council of the Rochester Chamber of Commerce. George C. Dent, executive secretary, 205 Wacker Drive, Chicago.

National Manufacturers' Association. Combined assembly with the National Industrial Council in New York City, October 22-24. George S. Doudinot, secretary, 11 W. 42nd St., New York City.

American Management Association. Autumn convention, Palmer House, Chicago, Nov. 13-15. W. J. Donald, managing director, 20 Vesey St., New York City.

Iron and Steel Division, American Society of Mechanical Engineers. Second national meeting, Chicago, November 14-15. Thomas Wilson, chairman of Chicago local section host, 7 S. Dearborn St., Chicago.

Society of Automotive Engineers. Production meeting, Book-Cadillac Hotel, Detroit, Mich., Nov. 22-23. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York, week of Dec. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Seventh National Exposition of Power and Mechanical Engineering. Held at Grand Central Palace, New York, N. Y., week of December 3.

The Weekly Price Guide

Rise and Fall of the Market

THE principal hot-rolled steel products moved up 5c., to $1.90 per 100 lb., base, Pittsburgh, during the week ended Oct. 4. This advance covers shapes, plates and soft steel bars, with reinforcing bars at $2 per 100 lb., f.o.b., mill. Back of the present strength in the finished steel market is a corresponding firmness in pig iron and scrap. Heavy melting steel scrap is reported as being particularly scarce. All price changes of the week in the accompanying table were advances, with the single exception of increased discounts on leather belting. The upward movement affects steel sheets; non-ferrous metals, raw, fabricated or scrap; and linseed oil.

(*All prices as of Oct.* 5, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$19.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.12
BIRMINGHAM	
No. 2 Foundry	16.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	20.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.51
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. o 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4 50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00@2 10	3.35	3.25	3.90*
No. 12	2.05@2.15	3.40	3.30	3.95*
No. 14	2.15@2.25	3.45	3.35	4.00*
No. 16	2.25@2.35	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.40@2.45	3.60	3.30	4.00
No. 22	2.55@2 60	3.75	3.45	4.15
No. 24	2.60@2.65	3.80	3.50	4.20
No. 26	2.70@2.75	3.90	3.60	4.30
No. 28	2.85@2.90	4.05	3.75	4.45
Galvanized				
No. 10	2.80@2.95	3.95	3.65	4.25
Nos. 12 to 14	2.90@3.05	4.05	3.75	4.35
No. 16	3.00@3.15	4.15	3.85	4.45
No. 18	3 15@3.30	4.30	4.00	4.60
No. 20	3.30@3.45	4.45	4.20	4.75
No. 22	3 35@3.50	4.50	4.25	4.80
No. 24	3.60@3.70	4.65	4.35	4.95
No. 26	3.75@3.90	4.90	4.60	5.20
No. 28	4.00@4.15	5.15	4.85	5.45

250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—¼	⅜	½	⅝	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$@$\frac{1}{2}$-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			16.00
Tin, Straits, pigs, New York			51.50
Lead, pigs, E. St. Louis	6.32½	New York	8.00
Zinc, slabs, E. St. Louis	6.25	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.50	13.75	14.25
Copper sheets, base	24.00	23.50	24.00
Copper wire, base	20.62½	19.62½	17.25*
Copper bars, base	22.50	22.00	23.00
Copper tubing, base	25.50	25.00	25.50
Brass sheets, high, base	19.75	19.25	19.75
Brass tubing, high, base	24.62½	24.12½	24.62½
Brass rods, high, base	17.50	17.00	17.50
Brass wire, high, base	20.25	19.75	20.25

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25.00*	24.30	24.30
Zinc sheets (casks)	10.00@10.50	11.00	10.01
Solder (½ and ½)	34.00	33.00	31@34
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			67.75
Commercial genuine, intermediate grade			53.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.25
Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:			
Ingots 35.00	Electrolytic 37.00	Shot 36.00	

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper	13.25 @13.50	12.00	12.25@12.75
Copper, heavy, and wire	12.50 @13.25	11.25	11.62½@12.00
Copper, light, and bottoms	11.25 @11.50	9.75	10.50@11.00
Heavy lead	5.25 @ 5.50	5.25	4.75@ 5.25
Tea lead	3.50 @ 4.00	3.75	3.75@ 4.25
Brass, heavy, yellow	7.25 @ 7.75	7.75	7.50@ 8.00
Brass, heavy, red	10.00 @10.50	10.00	10.00@10.50
Brass, light	6.25 @ 6.50	16.25	6.50@ 7.00
No. 1 yellow rod turnings	8.50 @ 8.75	7.75	8.00@ 8.50
Zinc	3.25 @ 3.50	3.25	2.87½@3.37½

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box				
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb	.15½	38.00 per M	.17
Sal soda, per lb	.02	.02	.02
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb	.108	.105	.108
Cutting oil, about 25% lard, in 5 gal. cans, per gal	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft per inch of width for single ply.:			
Medium grade	30–10%	30–10%	35%
Med. grade, heavy wgt.	30–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	50%	50–10%	50%
Second grade	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0325	$0.0325	$0.0324
Cold drawn shafting	per lb.	.034	.034	.04
Brass rods	per lb.	.175	.17	.16
Solder (½ and ½)	per lb.	.34	.3225	.37
Cotton waste, white	per lb.	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia	per 100	3.05	3.05	3.10
Lard cutting oil	per gal.	.65	.65	.65
Machine oil	per gal.	.30	.30	.27
Belting, leather, medium	off list	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$4.29	$4.29	$4.29
*Emery paper	10.71	10.71	10.71
†Emery cloth	20.97	20.97	20.97
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.32	1.32	1.32
Cloth	3.05	3.05	3.05
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.75@3.00
Coke, prompt foundry, per net ton	Connellsville,		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1⅛ and 1¼ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ½-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal—will receive bids until Oct. 16, for woodworking machines, punches, etc.

Mich., Battle Creek — Nicols & Shepard Co.—assembly equipment, traveling crane, etc., for proposed 1 story, 100 x 400, 88 x 100 and 58 x 100 ft. threshing machine factory on Marshall St. Estimated cost $275,000.

Mich., Detroit — Chrysler Motor Car Corp., 341 Massachusetts Ave., Highland Park—auto chassis and assembly equipment for proposed 4 story, 100 x 125 ft. factory on East Jefferson Ave., here. Estimated cost $100,000.

Mich., Detroit—The Crane Co., 836 South Michigan Ave., Chicago, Ill.—overhead conveyors for handling pipe for proposed 1 story factory on St. Jean Ave. Estimated cost $150,000.

Mich., Detroit—F. Joseph Lamb Co., 6343 Wight St.—large power punch press for trying out sheet metal dies.

Mich., Saginaw—Baker Perkins Co., Inc. —miscellaneous machinery and equipment for proposed 1 story, 100 x 340 ft. foundry on Hess St. Estimated cost $65,000.

O., Cleveland — Rectifier Engineering Service, 4837 Rockwood Rd.—light screw cutting lathe, small drill press, etc.

O., Salem—Mullins Mfg. Co. (radiators and auto bodies, etc.)—ten double action press for proposed factory. Estimated cost $50,000 to $75,000.

Tex., Beaumont — Kansas City Southern Ry. Co., Kansas City, Mo., B. B. Brain, Purch. Agt.—machinery and equipment for proposed repair shops, roundhouses, etc., here. Estimated cost $700,000.

Tex., Fort Worth—Texas-Worth Tool Co. —machinery and equipment for the manufacture of tools and parts used in the oil fields for recently acquired plant.

Tex., Silverton — Holt & Lightsey—air compressor, electric drill, hone press and reamers for proposed garage and filling station.

Ont., Kitchener—Pollock Welker Ltd., 480 Victoria St.—machinery and equipment for the manufacture of radio equipment for recently acquired plant. Estimated cost $25,000.

Ont., Windsor—Chrysler Corp. of Canada Ltd., 300 Tecumseh Rd., J. D. Mansfield, Gen. Mgr.—complete automobile manufacturing equipment for proposed plant. Estimated cost $1,500,000.

Opportunities for Future Business

Conn., New Haven—G. M. MacKenzie, 26 Water St., will build a 1 story, 50 x 150 ft. machine shop on Water St. Estimated cost $40,000. L. F. Caproni, 1056 Chapel St., Archt.

Conn., Stamford—Redman Chevrolet Co., Mill Hill Ave., is receiving bids for a 2 story, 50 x 100 ft. garage and repair shop on Mill River St. Estimated cost $50,000. Fletcher Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archt.

Conn., Stamford—Southern New England Telephone Co., 157 Church St., New Haven, is having revised plans prepared for a 1 story, 87 x 162 ft. garage on Jefferson St., here. Estimated cost $60,000. R. W. Foote, 185 Church St., New Haven, Archt. Former bids rejected. Noted Sept. 20.

Ga., Rome — Rome Electric Range Co., plans the construction of a 1 story, 50 x 250 ft. plant including foundry, machine shops, etc.

Ga., Rome — The Taylor Iron Works & Supply Co., W. A. Taylor, Pres., 1014 Broadway, Macon, manufacturers of machinery and parts, plans the construction of of three additional units to plant including foundry, machine and pattern shops, etc.

Ill., Chicago—Knight Soda Fountain Co., 2701 North Kildare Ave., awarded contract for a 96 x 160 ft. factory at 4250 Schubert Ave. Estimated cost $30,000.

Ind., Indianapolis—Link-Belt Co., Holmes and West Michigan Sts., awarded contract for the construction of a 3 story factory. Estimated cost $150,000.

Ind., Indianapolis — Robert McGregor, Consolidated Bldg., awarded contract for a 70 x 200 ft. machine shop and garage at 1011 North Pennsylvania St. Estimated cost $42,000.

Ind., Indianapolis—Wheeler-Schebler Co., 1302 Barth Ave., manufacturers of carburetors, awarded contract for the construction of a factory. Estimated cost $50,000.

Ia., Sioux City—The Albertson & Co., manufacturers of automotive tools, has work under way on the construction of a 44 x 155 ft. addition to plant. Estimated cost $60,000.

La., Monroe—The Ouachita Iron Works, Inc., plans the construction of a plant including foundry, machine, blacksmith and welding shops, etc.

Me., South Portland (br. Portland) — Hunnewell Estate, c/o Edwards Sales Co., 443 Congress St., Portland, Archt., is having plans prepared for a 1 story, 90 x 120 ft. repair and service garage on Main St., here. Estimated cost $45,000.

Mass., Brockton — Brockton Gas Light Co., G. H. Priest, Mgr., 54 Main St., is receiving bids for a 1 story, 125 x 125 ft. garage and repair shop on School St. Estimated cost $50,000. C. H. Tenney Co., 200 Devonshire St., Boston, Engr. Noted Oct. 4.

Mass., Chelsea (Boston P. O.)—Everett Ave. Auto Parts Co., 234 Everett Ave., is receiving bids for a 1 story, 45 x 100 ft. machine shop. Private plans.

Mass., Haverhill—Smith Motor Car Co., A. J. Smith, 88 South Main St., will build a 1 story, 100 x 135 ft. repair and service garage at 74-84 South Main St. Estimated cost $45,000. J. E. Allen, 283 Essex St., Lawrence, Archt.

Mass., Somerville (Boston P. O.) — The Vacuum Co., 105 Mystic Ave., awarded contract for the construction of addition to factory. Estimated cost $100,000.

Mich., Detroit — Holcroft & Co., 6545 Epworth Blvd., is having plans prepared for a 1 and 2 story, 105 x 180 ft. factory for the manufacture of foundry equipment on Westwood Ave. C. L. Phelps, 504 Detroit Savings Bank Bldg., Archt.

Mich., Detroit — Lincoln Mfg. Co., 2630 Erskine St., manufacturers of electrical supplies, awarded contract for a 4 story, 85 x 100 ft. factory on Chene St. Estimated cost $70,000.

Mich., Flint—A. C. Spark Plug Co., Dort Highway, awarded contract for a 72 x 277 ft. heat treat building and 72 x 225 ft. die casting building for plant. Private plans.

Mich., Lansing — Olds Motor Car Co., Division St., awarded contract for a 1 story, 100 x 180 ft. addition to automobile factory on Division St. Estimated cost $50,000.

Minn., St. Paul — Ballard Storage & Transfer Co., 10 East 4th St., awarded contract for a 4 story garage at Third and Wabasha Sts. Estimated cost $250,000. Noted Aug. 2.

N. Y., Auburn—Commissioner of Correction, Albany, awarded contract for the construction of a shop building at Auburn State Prison, here. Estimated cost $232,-500. Noted Sept. 20.

N. Y., Brooklyn—Gillen Bros., 19 Clinton Ave., awarded contract for the construction of a 1 story garage at Clinton and Flushing Aves. Estimated cost $45,000.

N. Y., Brooklyn — E. Leshnower, 1342 East First St., plans the construction of a garage, etc. at Coney Island Ave. and Ave. L. Estimated cost $60,000. M. Klein, 65 Court St., Archt.

N. Y., New York — Big Four Realty Corp., N. Michel, Pres., 311 West 95th St., plans the construction of a 100 x 125 ft. addition to garage at 252 West 87th St. Estimated cost $100,000. De Young & Moscowitz, 11 East 44th St., Archts.

N. Y., New York — Interboro News Co., S. P. Booth, Pres., 244 West 42nd St., plans the construction of a 6 story auto repair shop, paint shop, garage, etc. at 525 West 52nd St. Estimated cost $200,000. R. G. Cory, 30 Church St., is architect.

N. Y., Schenectady — Carboloy Co., 350 Madison Ave., New York, plans the construction of a plant for the manufacture of metal alloys, here. Estimated cost to exceed $200,000.

O., Cleveland — Buckeye Forging Co., J. W. Baxter, Pres., 10205 Harvard Ave., had plans prepared for a 1 story, 60 x 120 ft. machine shop. Estimated cost $50,000. Christian, Schwarzenberg & Gaede, 1900 Euclid Bldg., Archts.

O., Cleveland — A. Foss, 9508 Quincy Ave., manufacturers of fishermen supplies, awarded contract for the construction of a 1 and 2 story, 47 x 80 ft. factory at 2891 East 79th St. Estimated cost $40,000.

O., Cleveland—Lyons Machine Co., J. H. Lyons, Pres., 5601 Tillman Ave., awarded contract for a 1 story, 50 x 50 ft. addition to machine shop. Estimated cost $40,000.

O., Cleveland—State of Ohio, c/o J. E. Harper, Dir. of Public Welfare, Columbus, is having plans prepared for a 1 story, 120 x 125 ft. industrial building on Turney Rd., here. Estimated cost $75,000. H. B. Briggs, Hartman Bldg., Columbus ,Archt.

Okla., Oklahoma City—H. A. Heckard, 11 West Main St., had plans prepared for a 6 story, 100 x 140 ft. garage. Estimated cost $150,000. Layton, Hicks & Forsythe, 906 Baniff Bldg., Archts.

R. I., Providence—Petteruti's Motor Sales Co., 1051 Chalkstone Ave., is receiving bids for a 1 story, 60 x 100 ft. repair shop on Chalkstone Ave. Estimated cost $40,000. F. Chiaverini, 32 Broadway, Archt.

S. D., Sioux Falls—International Harvester Co., 606 South Michigan Ave., Chicago, Ill., plans the construction of a 172 x 229 ft. addition to plant here.

Tenn., Chattanooga—The Crane Co., 836 South Michigan Blvd., Chicago, Ill., manufacturers of heating plant radiators, plans the construction of a plant here.

Tex., Dowling (mail Nederland) — Texarkana & Fort Smith Ry. Co., Texarkana, plans a $1,000,000 development program near here including machine shops, roundhouse, transportation yard, etc. W. G. Morgan, Ch. Engr.

Tex., Houston — Houston Lighting & Power Co., Electric Bldg., awarded general contract for the construction of a 1 and 3 story, 108 x 300 ft. service and shop building on Canal St. Estimated cost $350,000.

Wis., LaCrosse — National Gauge & Equipment Co., P. M. Gelatt, Pres., subsidiary of MotoMeter Co., 11 Wilbur Ave., Long Island City, N. Y., awarded contract for a 2 story, 130 x 160 ft. addition to plant, here. Estimated cost $100,000.

Wis., Manitowoc — National Tinsel Mfg. Co., C. F. Protz, V. Pres. and Genl. Mgr., awarded contract for a 3 story, 50 x 150 ft. addition to plant.

B. C., Marpole — British Columbia Box Co., 295 West 2nd Ave., Vancouver, plans the construction of a factory on Heather St., here. Estimated cost including equipment $20,000.

Que., St. Johns—Russell Mfg. Co., J. M. Russell, Pres., East Main St., Middletown, Conn., plans the construction of a plant f the manufacture of brake lining, here. Estimated cost to exceed $40,000.